JOURNAL
OF THE
Association *of* American Medical Colleges

Volume 17 JULY, 1942 Number 4

The Teaching of Tuberculosis*

E. W. HAYES

Chairman, Committee on Undergraduate Education in Medical Schools
of the American College of Chest Physicians
Monrovia, California

I want to express my appreciation for the privilege and the honor of addressing this body at its annual meeting. I realize that, as representatives of the medical schools of this country, you have many problems to settle dealing with the practice of medicine in its various phases, and that you are, perhaps, more or less continuously besieged by the representatives of the various fields of medicine to give more attention and more time to this or that or the other specialty. Nevertheless, I am happy for the opportunity to talk to you on the subject of the teaching of tuberculosis in the medical schools. I speak as one who, after spending a number of years in the practice of general medicine and surgery, has devoted his work for more than twenty years entirely to the diagnosis, treatment and prevention of tuberculosis, and to the teaching of its fundamentals to medical students and interns. These interns have come from the medical schools throughout the country.

I feel that, through an efficient system of teaching this subject, all medical schools have an opportunity to render a valuable public health and medical service. It is true, that, since the discovery in 1882 of the tubercle bacillus as the cause of tuberculosis, much has been done to combat this disease. It is also true, that, during the past twenty-five years, the mortality from tuberculosis throughout the United States has decreased from 200 to less than 50 per 100,000 of the population.

In spite of what has thus far been accomplished in the fight against tuberculosis in this country, this disease still remains a very serious health and medical problem. Approximately 110,000 new cases of tuberculosis develop each year. We have continuously in this country between 300,000 and 400,000 cases of active tuberculosis, and there are approximately 70,000 deaths each year from tuberculosis, in addition to the vast amount of human suffering and economic loss that result from this disease.

While tuberculosis has dropped from first to seventh place as the cause of death in the United States, it still occupies first place as the cause of death in

*Read at the Fifty-second Annual Meeting of the Association of American Medical Colleges, held in Richmond, Va., October 27-29, 1941.

the age group from 15 to 45—that is, during the active, productive period of life. In other words, in spite of what has been accomplished up to the present time, tuberculosis is one of the infectious diseases that still presents a serious problem.

No specific for the cure or prevention of tuberculosis has been developed; therefore, we must depend on the education of the public, as a whole, in our attempts to combat this disease. However, even in the absence of a specific for tuberculosis, we now recognize this disease as being both preventable and curable. We know that if we were to put into working operation the facts which we have at hand today concerning its prevention and cure, tuberculosis would shortly be brought under a control equal to that of many other once serious infectious diseases.

What has been done so far in the educational campaign against tuberculosis has been accomplished almost entirely by the laity. Except for a few physicians who, through a personal experience with the disease have become interested, and have devoted their time and effort to the anti-tuberculosis movement, the medical profession, in general, has taken but a small part in this fight. What can be accomplished by the laity has, for the most part, reached a saturation point, and for the final solution of this problem it is essential that the medical profession must take the lead. Especially is this true of the man in general practice—the family physician. It is the family physician who is in a position to see the disease in its early and more curable stage. It is the family physician who has the confidence of the patient and of the patient's family, and, consequently, is in a position to induce the patient to do what he should, not only to regain his health, but also to prevent the further dissemination of the disease.

Five years ago, the American College of Chest Physicians, which at present has a membership of more than one thousand qualified chest physicians scattered throughout the United States, adopted as one of its chief objectives the endeavor to bring about conditions in this country whereby the medical profession, as a whole, would take the part it should in eradicating tuberculosis.

I am here today representing that organization. For the past five years, I have been chairman of the committee which has been working on this endeavor. During the first years of our work, we made a study of the qualifications of the medical graduate, as these qualifications pertain to an understanding of chronic diseases of the lungs and tuberculosis in particular. Our conclusion was that only a very small per cent of the young men and women graduating from medical colleges have a training in, or an understanding of the fundamentals which have to do with the technique and importance of early diagnosis, the technique and importance of early, intensive treatment, and the technique and importance of the prevention of tuberculosis, that will enable them to be of any material assistance in combatting the disease.

It is not our idea that medical students should be made specialists in tuberculosis, but simply that they be given a working knowledge of the fundamentals which have to do with its early diagnosis, treatment and prevention.

It is the opinion of our committee that, unless the future doctor receives this training during his undergraduate years, there is very little chance that he will receive it after he leaves school. Only one institution out of every twenty-four where internships are served, offers a service in tuberculosis. As Dr. Casparis of the School of Medicine of Vanderbilt University told us at the meeting of the National Tuberculosis Association held in Los Angeles, in 1938, "If we are going to interest the man in general practice in tuberculosis, we must contact him on an individual basis." He added that it is possible to contact him on an individual basis only when he is a medical student, and that unless we interest the general man when he is a student, we cannot attract his attention, or arouse his interest after he is out in practice, by barrage after barrage of literature on tuberculosis, for the same reason that he does not attend clinics or lectures on this subject.

I want to make it clear that the members of the profession which I represent do not ask that, in general, more time be allotted to the teaching of this subject than is now provided in the curricula of our medical schools. According to our survey, only a relatively small number of schools will have to devote more time to this subject in order to teach it adequately. What we are requesting, and what it is hoped will be put into practice, is an arrangement for the provision of a systematic use of the time now allotted for the teaching of tuberculosis, as well as adequate teaching material, and, finally, for the provision of teachers who are qualified through experience and training.

In accordance with these requests, the committee representing the American College of Chest Physicians, which is composed of a number of men now connected with medical schools in various parts of the country, has formulated and submitted a schedule for the teaching of chronic diseases of the lungs in our schools. It is the feeling of the committee that this schedule is elastic enough so that it can be adjusted to all of our medical schools. In submitting this schedule, the committee realizes that there is a wide difference in the conditions under which our medical schools operate, particularly in regard to the availability of material suitable for teaching chronic diseases of the lungs.

This committee also is aware that tuberculosis comes up repeatedly, especially in differential diagnosis in all branches of medicine and surgery taught in medical schools. However, past experience has very clearly demonstrated that students cannot be taught a practical working knowledge of tuberculosis except by a definite, logically arranged system through which this subject is presented, together with equipment by which satisfactory teaching material can be furnished, and with teachers equipped through special training and through special experience, such as is called for in the schedule which has been formulated. The committee agrees that tuberculosis may and, perhaps, should be included in the department of internal medicine, but if so, it should be handled as a subdepartment. If it is handled as a subdepartment, it not only will attract more effective

attention from the teaching staff, but it also will stimulate greater interest on the part of the students.

This schedule provides primarily for the teaching of tuberculosis. However, in addition, it offers an opportunity for the student to obtain a working knowledge of other chronic diseases of the lungs. In arranging this schedule, certain factors regarding tuberculosis, which must be recognized in teaching students, have been kept in mind. They are, first, that tuberculosis is a chronic disease, and its course is not one of weeks and months, but of months and years. Second, that during this course of months and years, the disease is characterized by sudden and unpredictable changes which can only be understood and met by close contact with the patient during the period of his disease. Third, that tuberculosis is an individual disease, that is, that while there are certain generalities that apply to the treatment of tuberculosis as a whole, no two persons respond exactly alike, and, therefore, each patient with this disease must be treated as an individual, if he is to have the opportunity to recover.

Our committee feels that the outline which it has prepared and desires to submit to medical schools as a guide in the teaching of tuberculosis, will, if followed, prepare the medical student to take the part that he should and must take in the solution of the problem of tuberculosis.

In our survey of the medical schools, we found that bacteriology and pathology, as well as immunology and allergy, as they relate to tuberculosis, are, at the present time, taught satisfactorily in most schools in the first and second years. To give the medical student the necessary long range view of tuberculosis, in the opinion of this committee, the teaching of the clinical aspect of tuberculosis should be spread over the third and fourth years. Under such a plan, the student will be able to keep before him the various phases of the disease, and correlate them with his knowledge of other medical and surgical conditions. He will, at the same time, also be able to follow the patient for a sufficient length of time to become familiar with the general course of the disease.

Accordingly, it is suggested in the schedule that at the beginning of the third and fourth years, a group of patients, representing the various types of tuberculosis, be selected from the teaching material at hand. These patients should be followed and studied periodically throughout the third and fourth years.

There is provision in the schedule for eighteen formal one hour lectures on the various phases of tuberculosis. These lectures are to cover, in a logical order, the fundamentals of tuberculosis. It is suggested that nine of these lectures be given at the beginning of the third year, and the other nine at the beginning of the fourth year. These lectures are to be given by an instructor specializing in the field, covered by any particular lecture.

As already pointed out, in addition to the formal lectures, a certain amount of time is to be spent with the instructors in informal meetings or seminars, periodically observing and studying patients cared for under conditions that make

them suitable teaching material. It is suggested in the schedule that a certain amount of the student's time should be spent in outdoor chest clinics where he will have an opportunity to become familiar, not only with the diagnosis of tuberculosis, but also with the procedure of adequate case finding. When students, during their upper class years, are given an opportunity to observe and study patients, both in sanatoria and in clinics, they will not only obtain a working knowledge of tuberculosis, but they will retain this knowledge when they go out to practice.

In order to obtain the right conception as to how tuberculosis should be handled, and to have his interest in the subject aroused and maintained, the student should see the patient under the most favorable circumstances. Consequently, patients in general hospitals, particularly if placed promiscuously in medical wards, are not satisfactory teaching material, because, as a general rule, in such an environment, patients are not able to adjust themselves to the cure, and as a result they have very little, if any, opportunity to overcome their disease. Such material, if used for teaching purposes, presents tuberculosis to the student more or less at its worst, and leaves him with the wrong impression of what can and should be done for patients who have pulmonary tuberculosis. I think most of us can recall that this was our experience as medical students.

In the schedule submitted, there is provision for a maximum and a minimum number of hours to be devoted to the teaching of tuberculosis. The maximum number of hours suggested is 185 for the four years course. We arrived at this figure by taking the average number of hours devoted to the teaching of tuberculosis by the ten medical schools of this country which, as a result of our survey, we felt presented this subject most efficiently to the student. The number of hours in the minimum schedule is 76. We felt that this was the least amount of time in which the subject could be presented in a satisfactory manner. One of our outstanding medical schools stated that 4 per cent of their teaching time was allotted to the study of tuberculosis. Another prominent school stated that the total time devoted to the subject of tuberculosis during the four year period was 500 hours.

I appreciate the fact that deans are charged with the responsibilities and the destinies of medical schools. I also am aware that you are endeavoring to have the medical schools serve their purpose to the public by devoting time and effort to each particular field of medicine or surgery in proportion to the importance of that subject as a public problem.

As a representative of those medical practitioners who, through their experience and work, are in a position to understand the problem of tuberculosis and the factors involved in its solution, I have spoken. I hope that you will have time to think over what I have said, and that after you go back to your respective schools, you will find it possible to consider the establishment of provisions in your medical curricula, if they are not already there, for a training of the student that will enable him to take the part he must take in the fight against tuberculosis.

SCHEDULE FOR TEACHING CHRONIC DISEASES OF THE LUNGS IN MEDICAL SCHOOLS

FORMAL LECTURES TO BE GIVEN DURING THE THIRD YEAR

Lecture I.—Epidemiology of Tuberculosis—to be given by a chest specialist.

- Historical.
- Importance.
- Morbidity.
- Prevalence of Infection.
- Clinical Significance of Infection.
- Mortality from Tuberculosis.
- Forms of Tuberculosis.
- Factors Influencing Mortality.
- Inheritance.

Lecture II.—Bacteriology: The Newer Biology of the Tubercle Bacillus to be given by a bacteriologist.

- Historical and General Considerations.
- Acid-fast Bacteria.
- Variability.
- Clinical Significance of Nonacid-fast Form.
- Tubercle Bacillus in the Blood.
- Atypical Tubercle Bacilli.
- Atypical Pathological Responses.
- Allergic and Immunological Considerations.

Lecture III.—The Pathology of Pulmonary Tuberculosis—to be given by a chest specialist or pathologist with extensive experience in tuberculosis.

- Introduction.
- Histopathology of Pulmonary Tuberculosis.
- Different Forms of Pulmonary Tuberculosis.
  - The Tuberculosis Primary Lesion.
    1. Primary Complex of Ranke.
    2. Stage of Generalization.
    3. Stage of Isolated Tuberculosis.
  - Progressive Pulmonary Tuberculosis.
    - A. Acinous-Nodose Tuberculosis.
    - B. Caseous Pneumonia.
    - C. Indurative Tuberculosis.
    - D. The Tuberculous Cavity.
- Pulmonary Hemorrhage in Tuberculosis.
- Changes in Lymph Nodes.
- Pulmonary Changes in Late Generalization.
- Tuberculosis of the Pleura.

Lecture IV.—Pathologic Physiology of the Tuberculous Lung—to be given by a physiologist or chest specialist.

- Functional Disturbances.
  1. Mechanics of Respiration.
     - (a) Respiratory Movements of Chest.
     - (b) Diaphragm-Mechanism of Cough.
     - (c) Respiratory Movements of Lung.
     - (d) Action of Bronchial Muscles.
  2. Physiology.
     - (a) Gas Exchanges in the Lung.

(b) Dissociation of Oxyhemoglobin.
(c) Dissociation of CO_2.
(d) Regulation of Respiration.
(e) Gas Exchanges in Pleural Cavity.

3. Pathological Physiology.
   (a) Gas Absorption.
   (b) Tuberculous Cavities.
   (c) Atelectasis and Fibrosis.
4. Mechanics of Cure.
5. Intrapleural Pressures.
   (a) Pneumothorax.
   (b) Gas Analysis.
   (c) Physiology of Thoracoplasty.

Lecture V.—Diagnosis of Tuberculosis by Laboratory Tests—to be given by a bacteriologist.

Laboratory Diagnosis.
Staining Methods for Tubercle Bacillus.
Animal Inoculation.
Cultivation of Tubercle Bacilli.
    Methods and Media.
Differentiation of Human, Bovine and Avian Bacilli.
Serological Diagnosis of Tuberculosis.
Tuberculin Testing.
    Nature of Tuberculin.
    Nature of Reaction.
    Clinical Application of Tuberculin.
    Specificity of Tuberculin Reaction.
    Errors in Interpretation.
    Diagnostic Methods.
    Technique of Tuberculin Tests.
    Value of Tuberculin Testing.

Lecture VI.—Physical Diagnosis in Pulmonary Tuberculosis—to be given by a chest specialist.*

Inspection.
Palpation.
Percussion.
Auscultation.
    Normal.
    Pathologic.
    Adventitious Sounds.
    The Stethoscope.
History Taking.
Symptoms of Toxemia.
Reflex Symptoms.
Fistula in Ano.
Symptoms of Pulmonary Decompensation.
Physical Examination.
X-ray Examination.
Laboratory Examination.

*The committee suggests that a little booklet entitled "Diagnostic Standards," published by the National Tuberculosis Association, be given to each student at this stage in his course. These can be secured by writing to the national office in New York.

Lecture VII.—Classification of Pulmonary Tuberculosis (Primary Type)—to be given by a chest specialist.

X-ray Findings.
Diagnosis.
Differential Diagnosis.
General Discussion of Primary Tuberculosis and Its Relation to Secondary Tuberculosis.

Lecture VIII.—Classification of Pulmonary Tuberculosis (Secondary Type)—to be given by a chest specialist.

Pathogenesis.
1. The Exudative Reactions.
2. The Productive Forms.

Classification of Adult Type of Tuberculosis.
Ornstein's Classification.
1. Benign Acute Pulmonary Tuberculosis.
2. Exudative-Productive Tuberculosis.
3. Caseous-Pneumonic Tuberculosis.
4. Chronic Productive Tuberculosis.
5. Endobronchial Tuberculosis.

Lecture IX.—X-ray Findings in Secondary Pulmonary Tuberculosis—to be given by X-ray man doing only chest work or by chest specialist.

Physical Structure of Chest.
Hilum and Trunk Markings of the Lung.
Advance of Disease by Extension and Reinfection.
X-ray Evidence of Activity, Chronicity, Healing.
Evidences of Caseation; Cavitation; Ulceration.
Evidences of Arrest; the Near-healed Stage; Healed Tuberculosis.
Importance of Serial X-ray Studies for the Early Recognition of Cavity.
Classification as to the Extent of Involvement.
Role of X-rays in Classifying Tuberculosis.
Parallelism between Clinical, Roentgenological and Pathologic Findings.
The Term "Peribronchial Tuberculosis."
Basal Tuberculosis in Adults.
The Paradox of Positive Sputum with Negative X-ray Findings.
Summary of X-ray Value in Adult Pulmonary Tuberculosis.
Mistakes Most Often Made in X-ray Diagnosis.

OUTLINE OF INFORMAL WORK DURING THE THIRD YEAR*

1. First two-hour period.
   (a) First Hour: Discussion or seminar in review of epidemiology, bacteriology, and pathology of tuberculosis.
   (b) Second Hour: To be spent in the outpatient department of chest clinic, or sanatorium, or tuberculosis ward of a public hospital and to be devoted to the observation of patients and selection of a certain group that will be studied especially from the standpoint of diagnosis beginning with the history and followed by physical examination, laboratory findings and X-rays.
2. Second two-hour period.
   (a) First Hour: Discussion or seminar devoted to pathological physiology of tuberculosis and chronic lung diseases, laboratory tests in the diagnosis of tuberculosis and physical examination as related to the diagnosis of chest conditions.

*As has been suggested elsewhere, if possible there should be available at least a small group of patients, preferably in a sanatorium or a special ward, that can be followed along by the class and to which the different phases of tuberculosis, which have been studied so far, can be applied.

(b) Second hour: Devoted to study of selected group of patients demonstrating to the students as far as possible the above factors discussed during the first hour as they relate to these patients.

3. Third two-hour period.
   (a) First hour: Discussion or seminar devoted to classification of pulmonary tuberculosis.
      1. Primary.
      2. Secondary.
   (b) Second hour: Devoted to study of patients in outpatient chest clinics, sanatorium, or special wards with special reference to classification of tuberculosis and to observation of the selected group of patients.
4. Fourth two-hour period.
   (a) First hour: Discussion or seminar on X-ray films of normal chest and interpretation of film of abnormal chest.
   (b) Second hour: Devoted to examination of patients covering as far as possible all the phases of diagnosis, and to observation of the selected group of patients.
5. Fifth two-hour period.
   (a) Two hours devoted to study of patients from the standpoint of diagnosis including history, physical examination, laboratory findings and x-ray films of the chest, that is, review of all the work so far.

FORMAL LECTURES TO BE GIVEN DURING THE FOURTH YEAR

Lecture I.—Differential Diagnosis—When X-ray and Physical Findings are Slight and Indefinite, the Following Conditions to be Considered—to be given by a chest specialist.

Accessory Nasal Sinus Disease.
Influenza and Allied Streptococcic Infections.
Undulant Fever.
Heart Disease.
Pulmonary Amebiasis.
Trichiniasis.
Hyperthyroidism.
Neurasthenia.
Various Focal Infections.
Chronic Bronchitis and Pulmonary Emphysema.
Asthma.
Kidney Disease.
Gall Bladder Disease.
Diabetes.
Typhoid Fever.
Hodgkins' Disease.
Various Secondary Anemias.
The Leukemias.

Lecture II.—Differential Diagnosis When X-ray and Physical Findings are Moderate or Marked, the Following Conditions to be Considered—to be given by a chest specialist.

Bronchiectasis.
Lung Abscess.
Pulmonary Syphilis.
Pneumoconiosis.
Foreign Bodies.
Benign or Malignant Tumors.
Mediastinal Tumors.

Actinomycosis.
Blastomycosis.
Coccidiodal Granuloma.
Aspergillosis.
Hydatid Disease.
Pulmonary Distomiasis.
The Pneumonias.
Pleural Effusion.

Lecture III.—Prognosis in Pulmonary Tuberculosis—to be given by a chest specialist.
General Considerations.
Depends Primarily on Manner of Treatment
Clinical Types.
Relative Value of Physical Signs and Symptoms.
Complicating Disease Conditions.
Non-tuberculous Pulmonary Complications.
Extra-tuberculous Involvements.
Other Factors.
Prophylaxis.
Introduction.
The Sputum.
The Open Case.
Prophylaxis in Childhood.
Acquired Artificial Immunization.
Marital Tuberculosis.
The General Hospital in Care of the Tuberculous.

Lecture IV.—Treatment of Pulmonary Tuberculosis—to be given by a chest specialist.
Economic Factors.
Home Environment.
General Considerations.
Personal Hygiene.
Non-surgical Rest, Exercise and Occupation Rest.
Methods of Obtaining.
Rest and Exercise.
Graduated Exercise.
Future Occupation.
Diet.
General Considerations.
Obesity and Tuberculosis.
The Menu.
Special Diets.
Salt Restricted Dietaries in Tuberculosis.
Characteristics.
Theoretical Foundations.
Clinical Results.
Practical Applications.
A New Modification.
Mechanism.
Conclusions.

Lecture V.—Treatment of Pulmonary Tuberculosis (Cont.)—Medicinal, Symptomatic, and General Therapy—to be given by a chest specialist.
Specific Therapy.
Metallic Salts.
Calcium.

Vitamin D.
Creosote and Guaiacol.
Iodine.
Liver Extract.
Treatment of Symptoms.
Tuberculin Therapy.
Varieties of Tuberculin.
Indications.
Contra-indications.
Technic.
Heliotherapy.
Physical Properties of Light.
Biologic and Physiologic Effects of Light.
Light Sources.
Technique of Exposures.
Clinical Applications of Heliotherapy.
Climate Therapy.
General Considerations.
Favored Localities.
Climate and Extra-pulmonary Tuberculosis.

Lecture VI.—Treatment of Pulmonary Tuberculosis—(Cont.)—Artificial Pneumothorax—to be given by a chest specialist.

Introduction.
Historical.
Mode of Action.
Indications.
Contra-indications.
Selection of Cases.
Technique and apparatus.
Control of the Pneumothorax.
Complications.
Pleuritic Adhesions.
Influence on Contralateral Lung.
Influence on Symptoms.
End-Results of Treatment.
Classification of Pneumothorax Character.
Summary.

Lecture VII.—Treatment of Pulmonary Tuberculosis—(Cont.)—to be given by a chest surgeon.

Intrapleural Pneumolysis.
Limitations.
Indications for Operation.
Contra-indications.
Selection of Cases.
Surgical Anatomy.
Pleuritic Adhesions.
Operative Technique.
Complications.
Results of Treatment.
Conclusions.
Oleothorax.
Indications.
Contra-indications.

Technique.
Pneumothorax Pleuritis.
Complications.
End Results.
Phrenic Neurectomy.
Indications.
Operative Procedures.
Choice of Operations.
Complications.
Clinical Effects.
Results.
Summary and Conclusions.

Lecture VIII.—Treatment of Pulmonary Tuberculosis—(Cont.)—to be given by a chest surgeon.
Extra Pleural Thoracoplasty.
The Evaluation and Principles of Treatment of Cavities.
Indications.
Surgical Procedures.
Technic.
Post-operative Treatment.
Complications.
Results.

Lecture IX.—Treatment of Other Chronic Diseases of the Lungs by Surgery—to be given by a chest surgeon.
Indications.
Techniques.

FOURTH YEAR INFORMAL SCHEDULE ACCORDING TO MINIMAL NUMBER OF HOURS ALLOTTED

Four-hour teaching period each month.

1. First 4-hour period.
   (a) Teaching to be done in outpatient chest clinic, a sanatorium, or as a last choice, a tuberculosis ward of a public hospital.
   (b) First half hour or hour to be spent in reviewing by means of seminars or discussions differential diagnosis of chronic lung conditions.
   (c) Next 1½ to 2½ hours students under close supervision of instructor to study patients from standpoint of differential diagnosis based upon history, physical examination, chest X-rays, laboratory findings, and, if necessary, the clinical course.
   (d) Remainder of the period—not less than one hour—devoted to selecting a group of patients, from 6 to 12 or more, in a sanatorium or on the cure somewhere who will represent the various stages and types of tuberculosis and who are to be followed on the cure throughout the year by being seen and studied each month.

   NOTE: At the outset every effort should be made to acquaint the students with all the different phases of each case, including their temperament and disposition. Hereafter, we will refer to these patients as "the patients under continuous, prolonged observation."

2. Second 4-hour period.
   (a) First ½ to 1 hour devoted to further discussion or seminar on differential diagnosis of pulmonary tuberculosis pointing out especially the differential diagnosis of primary and secondary tuberculosis.
   (b) 1½ to 2½ hours during which students study patients from the standpoint of differential diagnosis under close guidance and supervision as was done in the last period. The work should be arranged so that cases of primary tuberculosis are available for study.

(c) During the last hour the time should be spent under close guidance of the instructor in observation and study of the patients under continuous, prolonged observation.

3. Third 4-hour period.
   (a) First hour: Discussion or seminar on the prognosis of pulmonary tuberculosis.

   NOTE: Importance of mental and emotional control of the patients in determining the prognosis should be stressed.

   (b) Two hours spent in studying patients in outpatient clinics, sanatorium, or tuberculosis wards who have been on the cure for a considerable time.

   NOTE: An attempt should be made to correlate the various phases of tuberculosis and to point out their bearing on the prognosis as well as to make clear the impossibility of definite prognosis in the disease.

   (c) One hour to be spent with the "patients under continuous and prolonged observation."

4. Fourth 4-hour period.
   (a) One to two hour discussion or seminar on the treatment of pulmonary tuberculosis.

   NOTE: The factors involved in the so-called dietetic, hygienic, rest regimen and home versus sanatorium treatment should be the topics for consideration.

   (b) One to two hours spent in observing and studying patients either in an outpatient clinic, a sanatorium, or a special ward for tuberculous patients who are either on the "cure" or who have left the "cure" and are being followed up.
   (c) One hour spent with "the patients under continuous, prolonged observation."

5. Fifth 4-hour period.
   (a) One to two hours in discussion or seminar on the medicinal and symptomatic treatment of tuberculosis and the consideration of climate and heliotherapy in connection with the treatment of this disease.
   (b) One to two hours to be spent in observation and study of patients who are on the "cure" and who have left the "cure" with special reference to the above named factors.
   (c) One to 1½ hours (depending on the amount of time left) devoted to the "patients under continuous, prolonged observation."

6. Sixth 4-hour period.
   (a) 3 to 3½ hours during which students are to accompany public health or visiting nurses, with the instructor when possible, out into the community where they will have an opportunity to observe case-finding, home treatment and social aspects of tuberculosis.
   (b) Time should be arranged so that the "patients under continuous, prolonged observation" may be seen, if only for a short time, so as not to lose continuity of observation and the interest of the student.

7. Seventh 4-hour period.
   (a) 1½ hours discussion or seminar on pneumothorax, intrapleural pneumolysis, oleothorax, phrenic neurectomy, and closely allied surgical procedures used in the treatment of pulmonary tuberculosis. The treatment of tuberculous empyema should be included in this discussion.
   (b) 1½ hours for the study of patients either in an outpatient chest clinic, in a sanatorium, or in a special tuberculosis ward of a public hospital who have received the above types of treatment.
   (c) The fourth hour is to be spent with the "patients under continuous, prolonged observation."

8. Eighth 4-hour period.
   (a) One to two hours for discussion or seminar on thoracoplasty and its various modifications. A discussion of other surgical procedures used in the treat-

ment of pulmonary tuberculosis and not already covered in the course should be included. Reference should be made to such surgery on non-tuberculous pulmonary conditions that has not been incidentally covered in the past.

(b) One to two hours for study of patients in outpatient chest clinic, a sanatorium, or in a special tuberculosis ward of public hospital of patients who have received the type of treatment under consideration during this period. Teaching the student the technique of these operations is not so important as is the teaching of the possibilities that can be obtained by carefully selected, ably operated cases.

(c) The fourth hour to be spent with the "patients under prolonged, continuous observation."

9. Ninth 4-hour period.

(a) Two hours of discussion or seminar covering a summary of the work during the medical course on tuberculosis.

NOTE: During this session the students should be made to realize that they are not supposed to be specialists in chronic diseases of the chest but that they should be tuberculosis conscious. They should also be made to understand that tuberculosis is a possibility in every case that may consult them.

(b) Two hours to be devoted to the study of the "patients under continuous, prolonged observation" from the standpoint of original diagnosis, treatment, and clinical course to date.

DISCUSSION

DR. H. G. WEISKOTTEN (Syracuse University School of Medicine): I have been very much interested in the papers on industrial health, and Dr. Hayes' paper on tuberculosis. Knowing the medical schools as I do, I do not believe that any of us are entirely satisfied that we are giving to the students all we would like to in terms of industrial medicine, nor all that we would like to in terms of tuberculosis. At the same time, I am not at all optimistic in regard to the incorporation of formal courses in our overcrowded curriculum. At the same time, it is my belief that there is something fundamental and important in the undergraduate teaching that is related to these subjects, and not alone related to tuberculosis but also to syphilis, cancer and many other diseases.

It is our responsibility to give our students a proper point of view and a proper appreciation of what their responsibilities will be in the various fields of medical practice. I will not discuss the matter of positive health in the presence of Dr. Ryerson, but I do think there is much to be done in connection with teaching the treatment of disease. It is my belief that medical education has for many years been too institutionalized, with too little consideration to the patient as an individual in his home, his living and working conditions, and in his relationship to his associates.

As I reported previously before this Association in discussions, at Syracuse we have tried to overcome this by seeing to it that our students do get into the homes of patients they have studied in the hospitals. They study the home, living and working conditions of the patient, from the standpoint of the factors that lead to the development of the disease, from the standpoint of convalescence, from the standpoint of the effect of the disease on other members of the family.

Students report on these visits at seminars. We have carried on such seminars for a period of about ten years and we believe that they are worth while and we are continuing them. A rather interesting development resulting from these seminars has been an appreciation of how little was actually accomplished by hospitalization on our medical ward. We were very much surprised to find that about 80 per cent of all patients on our

medical wards were suffering from chronic disease, perhaps a decompensated cardiac condition, a flare-up of a duodenal ulcer, an unbalanced diabetic, tuberculosis, syphilis and so on. We found that our ward patients after discharge had satisfactory medical supervision in only about 30 per cent of the cases.

At Syracuse we are now experimenting with an extramural resident. There is attached to the medical service of our hospital a man who has completed his training as a resident and who becomes an extramural resident. He is familiar with the patients on the medical wards of the hospital. He has an office in the hospital, he is responsible for the medical supervision of all patients discharged from the medical ward, makes home visits, shortens the period of hospitalization, many times by several weeks, and prevents rehospitalization. He is offering a continuity of medical care to which we will have to give serious consideration, especially because of the fact that there is an increasing percentage of medical care that involves the care of chronic disease.

And so I think that the important thing for us to get from these papers this morning is that in some way we must give our students a proper point of view and a proper appreciation of their responsibilities in connection with medical care.

Dr. Dean Cole (Medical College of Virginia): When the medical student, as a junior, is given instruction in tuberculosis or other so-called specialties, he should already be well grounded in bacteriology, immunology, epidemiology, pathology, pathologic physiology and have some understanding of the general principles of physical diagnosis. He has had two years of lectures, from which there was no escape, and assuming that he has a good foundation in the basic sciences, he should be in a receptive mood for clinical medicine. Since the evolution of the printing press, I feel that much time and effort have been wasted in lectures—even in lectures on tuberculosis. The sooner the instructor, the student and the patient can be brought together, the greater the opportunity for stimulating the student. This encourages him to think things through rather than to continue to accept all dogmatic teaching as irrefutable fact. I believe that up to a certain point teaching must necessarily be dogmatic and possibly autocratic. There comes a time, however, when a physician must think for himself, and, in my opinion, preparation for this should begin when he is an undergraduate. In teaching tuberculosis, if the patient and his problem can be considered as a whole, and his tuberculosis as a part thereof, then the microscope, the stethescope, the bronchoscope, the fluoroscope and the x-ray automatically receive the proper consideration as diagnostic aids. In the same manner, fresh air, diet, rest and collapse therapy take their respective places in treatment. I feel that the student is then prepared for an understanding of tuberculosis as it affects the patient and also as a public health problem. Whether or not the student is taught that tuberculosis is a systemic disease with local manifestations, or a local disease with systemic manifestations, becomes merely academic if he can be made to understand why one patient may recover and another patient, with apparently similar tuberculosis, probably will die. If the student can be shown patients with tuberculosis in its various stages, including those with complications, and see, first hand, the therapeutic agents utilized in assisting these patients to recover, he is better prepared for some independent thought on the treatment. Also, if he can see patients who, because of an uncontrolled open tuberculosis, have cost the community thousands of dollars in money, much illness and many lives because of an unrecognized and an untreated open tuberculosis in one individual, he is better prepared for some understanding of tuberculosis as a community health problem. One peep is better than two finesses.

The Integration of Teaching in Surgery and Anesthesia*

EVERETT IDRIS EVANS
Instructor in Pharmacology and Surgery, Medical College of Virginia
Richmond, Virginia

I have chosen to speak to you today of the problem of teaching a newly developed art as a branch of a very ancient art, i.e., instruction in the art and science of anesthesia as it relates to the teaching of surgery. With your indulgence, I should like to speak in general terms of specialization in medicine and especially to tell you of our particular philosophy as it relates to the teaching of the subbranches of surgery. While much of what I shall say regarding the dangers of specialization has probably been brought up and conclusions reached many times before this, the peculiar circumstances under which we meet in world turmoil today cause me to think that the problem is more acute and demands more sincere attention today than in the past.

It would seem that if the world leaders are to develop a method by which we can escape or emerge from the present chaotic state in which we find ourselves today, our leaders must be men of broad vision, men whose minds are attuned to many of the great problems that lie immediately before us. Those of us in the teaching branches of medicine are apt to be lulled into a sense of false security because we feel that our own profession has little to offer in the solution of problems of state and nation. This feeling of security undoubtedly springs from a sense that ours is a somewhat protected class. That ours is not a protected class, at least in dictator states, is known to all who are aware of the state of the profession in certain foreign lands. I mention this because I believe it is a direct result of undue specialization that allows many of our profession to shun contact with the broad general problem of living in a world of chaos.

That specialization can carry with it great dangers to a profession such as ours is certainly not a new thought. It is now just a little over 100 years since Emerson spoke of this in his famous Phi Beta Kappa address in 1837, "The American Scholar." In this address there is evidence that Emerson was acutely aware of the danger of men in the professions so withdrawing from the general state of affairs that they would no longer be interested in or care to cope with the general problems of the community and nation. In his brilliant analysis of the state of scholarship in the United States of the early years of the nineteenth century Emerson clearly perceived that after freeing itself from the fetters of European scholarship, American scholarship should strive to create in its circles men of broad interests, keen in their perception of nature and man, rather than to develop scholars and teachers who would be interested only in their private

*Read at the Fifty-second Annual Meeting of the Association of American Medical Colleges, held in Richmond, Va., October 27-29, 1941.

little halls of learning. Emerson remarks, "The scholar is that man who must take up into himself all the ability of the time, all the contributions of the past, all the hopes of the future. He must be a university of knowledges." He asks, "Is it not the chief disgrace in the world not to be a unit, not to be reckoned one character?" The Sage of Concord placed his condemnation on ultraspecialization when he said, "it is not a compliment but a disparagement to consult a man only on horses, or on steam, or on theaters, or on eating, or on books, and whenever he appears considerately to turn the conversation to the bantling he is known to fondle."

Following Emerson's time, we are all acquainted with the remarkable strides in the development of American scholarship, especially in the literary arts. Then, too, American medicine began to come of age and we find that following the War between the States schools in great number were established, dedicated to the teaching of the science (such as it was) and the arts of medicine. With the creation of these schools, we find the development of strong, many faceted teachers. Dr. Arno B. Luckhardt, in his interesting bibliographic sketch of Edmund Andrews (1824-1904), the discoverer of the modern anesthetic method which employs nitrous oxide and oxygen, has shown us such a teacher. In Edmund Andrews we find a superb example of a man whose catholicity of interests and broad understanding were so great as to make of him one of the genuine leaders of his time, not only in medicine but in the physical and biological sciences.

Here was a man first in the ranks of almost everything he essayed to do; we may ask, did this broad attachment to the problems of medicine and nature as a whole restrict his usefulness as a surgeon? If there is any question about this, I would refer you to Dr. Luckhardt's essay. Indeed, we find that the results are just the opposite of what some may have expected. Edmund Andrews' surgical judgment and his technical results seem to have far outstripped those of his fellow practitioners.

With the passing of the 19th century, the problem of specialization in the professions seems to have become increasingly acute. We find John Lancaster Spalding, Bishop of Peoria, stating in the late nineties of the last century as follows: "Division of labor makes everything cheap, men first of all, and the increasing tendency to specialization may have the effect not only to lower the standard of professional life but to interfere with the development in the professions of strong, many sided personalities, interesting in themselves and lending dignity to their callings; who, while they are masters in their several departments, are nonetheless at home in the whole world of human interest and specializations." Bishop Spalding was speaking of the lack of interest of men of the professions, whether medicine, law or the clergy, in the more general problems of their day.

It would be interesting to hear the indictment of this man of great learning had he been able to foresee the extent to which specialization could take place in our specialty—medicine. In his day, a doctor was still called on to treat most any ill. Certainly, the surgeon and a surgical teacher at the turn of the century had still a wide range of interests within his own specialty so that we know of esteemed surgeons who wrote well in the fields of orthopedic, gynecologic, abdominal, as well as in the broader field of general surgery. I can cite no better example than that of Stuart McGuire of this city whose clinics were so well known that they attracted students of surgery from all up and down this Eastern coast, from the Carolinas to Maine.

The past forty years have seen a marked divergence from the surgeon with the wide catholicity of interests. We are all aware of this fact. We now see in almost every university or college devoted to the teaching of the art and science of medicine, many small or large departments, each concerned with their own special interests of teaching and research. This may have been all to the good. It may well be true that this breaking up of the curriculum into its various categories has been responsible for the great development of American medicine and the lofty position which it now holds in world medicine. It may well be true that the intricacies, for example, of the problems of internal medicine are so great as to demand the internist's full attention so that he can have little time to pursue any interest in another field—such as surgery or pediatrics. Some of us doubt this. Certainly, we have seen the all too frequent example of the surgeon who from his intern days on has laid his stethoscope aside, or the ophthalmologist who may feel he had never had use for a stethoscope. These are extreme examples of the effects of specialization.

To get to the immediate point of this discourse; we are seeing in the present development and teaching of the art and science of anesthesia another example of what we can expect if this trend toward undue specialization in medicine is to continue. Time was when the surgeon carried a firm voice in the discussion of anesthesia problems. That such was once true I refer you to the fiftieth anniversary volume of the Introduction of Ether Anesthesia at the Massachusetts General Hospital. In this 1896 publication, commemorating the first public demonstration of ether anesthesia, we see many examples of the surgeon's interest in this special art of medicine. Indeed, to judge by the printed record, there was no anesthetist as such present to speak on this occasion. Instead we see the leading surgeons of that day acclaiming this great demonstration. We can read the remarks of McBurney, so well known to us for his incision, of Ashurst, leading surgeon of Philadelphia. And not only surgeons were there to give audible evidence to their interest in anesthesia; there were also present leading obstetricians of that day. Even the great neurologist, S. Weir Mitchell, read his famous poem on "The Birth and Death of Pain" in commemoration of the event. Here,

we see the type of doctor that Bishop Spalding had been calling for; men who were representative of the science and culture of their age. Apparently, the example set by earlier surgeons has not been followed in our day. We see in my chosen specialty the overdevelopment of specialties within a specialty. No longer does a surgeon bear with pride the name "general surgeon." He feels that to get anywhere in this branch of the profession, he must restrict himself to a subspecialty, such as gynecologic surgery, thoracic surgery and on down the line.

In the further development of medical science, it might be well to consider the advisability of calling a halt to this undue attempt at specialization and return to the practice of an earlier day when surgeons carried greater and more general interest in the practices of the specialty. It seems to me that in the matter of the further development of anesthesia in its relation to surgery a good start can be made. This we are trying to do at the Medical College of Virginia.

It is our contention that the interests of surgery can best be served if anesthesia shall remain an integral part of the discipline of surgery both in the teaching of surgery to students and to the postgraduate teaching of house officers and residents who intend to go into the practice of surgery. Regardless of what many have said about the importance of developing anesthesia as a specialty within itself, we have instituted a program of teaching and research in anesthesia as a part of the course in the department of surgery.

I can outline briefly our intentions and views as to the development of this teaching at our school. We have for some time thought there should be a closer relationship between the preclinical and clinical faculties. While we realize this belief is not unique with us, we feel we are making a sincere attempt to carry this view into actual practice. For instance, the student's introduction to anesthesia is not in the clinical years, but in his sophomore year, through a joint program carried on between the departments of surgery and pharmacology. We have planned that the member of the department of surgery who is most interested in anesthesia shall devote a considerable number of lectures and demonstrations to the classes in pharmacology on the subject of the fundamental pharmacologic basis of anesthesia. No attempt will be made to teach these preclinical students anything of the art of anesthesia. However, we believe that this cooperative teaching between pharmacology and surgery through anesthesia will better link up for the student the relation of pharmacology to clinical practices.

Too often, we all know, the student of medicine regards his first two years' instruction as something to be forgotten as soon as he arrives on the ward or in the operating room. I believe that we can serve a good function if we can help to dispel this belief.

In his fourth year, it is intended that the student shall get direct training in the art and problems of clinical anesthesia. The teaching in the sophomore year

should serve as a fundamental basis for this later training. Each student in his senior year, during his term on surgery, shall spend a week in the surgical operating clinic, where he will, under direct supervision, be taught the practices and art of administration of the simpler anesthesias. We intend to have the student give at least 10 anesthetics by himself under direct supervision and here, again, the attempt will be made to show the student the relation of the physiologic and pharmacologic action of anesthetics to the problem of the surgical use of anesthesia.

One of the curses of modern education has been the overdevelopment of the lecture system; the lecture has become almost a substitute for reading and discussion. We believe that it is essential in the integration of the teaching of anesthesia and surgery that lectures be well supplemented by some form of direct contact with the student. Therefore, we intend that in the student's clinical years the surgeon interested in anesthesia shall devote time to a small group of students, where discussion can be had not of prepared material but on questions that the student may bring to a conference. In this discussion group it is hoped that we may carry into real practice what I fear most surgeons pay only lip service to, i.e., of illustrating the relation of physiology to surgery. We hear on every hand surgeons exclaim that modern surgery owes its development to physiology and of the great importance of physiology in surgical practices; it is very rare, it seems to me, that these relationships are well brought out. There is, perhaps, no better place to demonstrate the relationship of physiologic mechanisms to surgical problems than in the integration of the teaching of anesthesia and surgery. This we hope to do in these group conferences with students who are especially interested in the matter.

As a final word about our teaching practices here as they relate to the integration of anesthesia and surgery, I should like to say a word about postgraduate teaching. To one who has finished five years of postgraduate hospital training as a house officer on up through a residency in surgery, it has occurred to me many times that the most neglected field of medical instruction is that of teaching interns, house officers and residents. As medical teachers we are missing a great opportunity to carry out our true function if we continually forget our responsibility to interns and house officers. For this reason we have instituted the practice of the surgeon in charge of anesthesia devoting a certain amount of his time to the actual instruction of those interns who have chosen surgery as a career. This is a highly important function of the department of surgery; many of our surgical interns and residents go into practice in communities where they will be the sole arbiters as to the choice of anesthesia and the anesthetic risk of the patient. In the teaching of the house officer and resident on surgery in the practices and art of anesthesia we believe in our department of surgery we can maintain anesthesia as an integral part of the discipline of surgery.

There is a final point that deserves consideration—that of the surgeon's direct responsibility to anesthesia matters. In the evaluation of the anesthetic risk of the patient, the surgeon's judgment should carry the greatest weight. During the course of the patient's examination and preparation for operation there is certainly no person better fitted to judge the patient's physical condition and to evaluate his risk for a given surgical procedure than the surgeon who is taking charge of him. The properly trained surgeon will know far better than any one else concerned in the operation just how well this or that patient is suited for a given anesthetic agent. Another point that bears mention: it is well known, certainly to surgeons, that should any disaster befall a patient because of a serious reaction to the anesthetic agent or processes itself, it is the surgeon and not the anesthetist who must bear full responsibility for this ill result. These facts make it all the more important that training in matters of anesthesia should remain or become a distinct part of the discipline of the training of a surgeon.

I have, perhaps, gone a long way around to discuss the problem of the integration of surgery and anesthesia and in doing so have, perhaps, paid too much attention to this matter of undue specialization. It seems evident to me, however, that the time has come when effort should be made to put a stop to the growing tendency to overspecialization in medicine. It may be that we have succeeded so well in separating the medical currriculum from the general curriculum of the university that we are no longer developing true scholars in medicine. In times such as those through which we are now passing, we must take pains to avoid the dangers of undue specialization so that we can see our own profession and its problems in perspective as well as under a microscope. The fate of our profession and the ideals on which it is founded may well prove in these days of world dilemma to depend on our ability to understand our particular problems as they relate to the needs of society and state. That understanding will be secured only if the medical teacher and student alike have for their training a broad intellectual and cultural basis.

Experiment Design and Judgment of Evidence*

ERRETT C. ALBRITTON

Professor of Physiology,
George Washington University School of Medicine
Washington, District of Columbia

It is a weakness of human nature, we are told, to look over into the other fellow's field and notice how green grows the grass there. If you do this, some one is likely to condemn you right off for wanting to climb the fence and leave your own field altogether. But there are other good reasons for looking across the fence. Maybe something is growing there that you could transplant into your own plot of ground, or maybe you see a tool lying around that you want. I hope this does not suggest any impropriety in your joining me in an excursion across the fence.

There is an interesting parallel between the development of medical science and law. At the heart of both is making decisions; in law, decisions that see to it that justice is done between man and man, and in medical science, decisions that lay down in the structure of the science thousands of new facts each year. In both fields the importance of a decision extends beyond the matter decided, for in both, decisions are used as precedents or foundations for still others yet to come. In both, great effort is made to see that the decisions fit the facts, but in only one of these, law, is the student given any formalized training in what we may call the science of making decisions in his field. I wonder if such a tool would not be useful on our side of the fence?

There was a time when in law the same rough tool was used that we are using now. We can imagine the snort of impatience that some lord of the manor, in feudal times, might have expressed, if on the "county court" days, when he called his serfs together, to hear any complaints one might have against another, some one had suggested that he have beside him a five hundred or a thousand page book on rules of evidence. Even King Solomon, in all his wisdom, apparently belonged to this same rough and ready school of jurisprudence; as, witness the reputed trial to determine which of the two mothers was the rightful claimant to the child. But law has come a long way since then, and law students now burn the midnight oil over their rules of evidence.

Suppose we should gather together, from your experience and mine, the rules of evidence for our field, used in medical investigation, in extending our science. What would they look like?

May the time not come, indeed, when our rules too will be put in a book, and will be a required part of the future medical student's library? The book has not been written yet, but let us look over the shoulder of this future student

*Read at the Fifty-second Annual Meeting of the Association of American Medical Colleges, held in Richmond, Va., October 27-29, 1941.

and see what it might contain. The book is open before him. The title could be "Rules of Evidence for the Medical Investigator," but even better, I think, "Experiment Design and Judgment of Evidence"; for although in law the judge does not design the situations that come before him for decision, we in medicine do. We can give sulfapyridine or sulfathiazole to pneumonia patients, or give nothing at all, and so, shape the cases that, as judges, we try. Our rules of evidence extend forward into the design of our experiments.

The student is reading and we read with him:

"The typical problem in medical investigation is a test of the action of some agent on the living organism or on some one of its functions. It is, in short, a problem of cause and effect. When it is finished, the investigator has evidence that either links together, or fails to link together, two things or events, one as the cause of the other. The decision on this evidence must be made with every known precaution to insure that it fits the facts."

This is old stuff to us. We have gone through years of work in our various fields, and anyone of us might have written it. We might even say that the unit of knowledge in our science, the brick of which our house is built, consists of two variables linked together by a causal relationship. "Exercise causes fatigue;" "histamine causes gastric secretion;" "germs cause disease." A thousand such pairs could easily be collected from the past investigations in any branch of medicine and on closer examination of any one of these branches we should find these pairs joined together with other pairs—like amino acids in a protein—into a complex interconnecting framework, the very structural core of the science. We look again at our student's book, and read:

"A decision that one thing or event is the cause of another is, fundamentally, a decision on a question of identity."

This is a bit philosophical, but, the philosophers tell us that this problem of identity permeates all the realms of our thought, so it is not surprising to find it buried beneath our decisions in medical investigation. We who work in the laboratory deal with our experimental series and our control series, and the clinical investigator subjects his cases, alternately, to one or the other of two treatments and collects, thus, his two series for comparison. It is these two series whose essential identity, or not, has to be decided, and our thoughts wander again to the legal profession where problems of identity also occur. In law, establishing identity, usually links the suspect to the crime, or the heir to the inheritance. In medical investigation, establishing identity does just the opposite—throws the case out of court—for if blood pressure before and after some new drug is identical, the drug's claim of an effect on blood pressure is denied.

We seldom find absolute identity. One of our acquaintances needs a haircut today. We see him tomorrow with short hair, and, perhaps, wearing a different tie, but we do not question his identity. Some differences "do not make any difference." But if our friend of yesterday approaches us today a foot taller than he was when we last saw him, we arrest our friendly salute in mid-air, certain

that we have made a mistake. Some differences make identity impossible. Impossible? No, but highly improbable. In this instance, the betting odds against identity would certainly be high.

So, in every day life, and in our scientific investigation, in linking cause to effect, we look for essential identity, or not, beneath any differences we find. Our problem in confronting any difference, the result of our experimentation, is to decide whether the difference compels us to conclude there is fundamental lack of identity, or whether the difference is merely superficial, the work, to introduce a technical term, of *chance.*

When we have completed a piece of work, have found a lower average blood pressure after the new drug, or a higher percentage of recoveries after the new treatment, how are we to judge whether the difference we have found is the effect of the agent we employed, or is due solely to chance? We have all made such decisions, but since we went to school, the keen tool of statistical method, as an aid in making them, has been coming into use. Our student has been reading on, as we have been talking, and it is not surprising to see him at a chapter heading, titled, "The Use of Probability in Decisions of Cause and Effect."

After a page or two of admittedly dry discussion we find the student a bit more alert at a paragraph headed "The Shooting Match." He reads: "The decision, as to the cause of an effect has been likened to a shooting contest between two rival marksmen. One is the *Agent* we employed in our experiment, the other is *Chance.* The *Agent* is a newcomer in such contests—never tested before. *Chance* is a chronic contender, shoots in every match. A strange condition of the contest is that the two shall fire at the target simultaneously. They step up, aim and fire together. A single bullet is found in the target. The judge merely looks in a memorandum he is holding and announces the agent as the winner; or, if not, declares the contest a 'mistrial,' if we may borrow a legal term."

Reading on—

"Strange as it may seem, where the cause of any effect has been proved by actual observation or experiment—cold freezes water, fire burns wood, pressing the button rings the bell—in every case the knowledge has come from such a contest. *Chance shoots simultaneously,* with the *Agent* in every experiment to determine the cause of an effect."

This little analogy has waked up our student, and has, perhaps, emphasized to us that no matter how good an experimental result looks, there is some possibility that it is due simply to chance. We read further:

"The decision, between the two marksmen, cannot be based on any direct evidence in favor of the *agent* employed, but must be based solely on the evidence regarding *chance.*"

The memorandum the judge consulted contained this evidence. It was chance's shooting record, and nothing more. The judge may have read something like this: "Chance can hit this target once in a hundred shots." Or

expressed in percentage, "in 1 per cent of his attempts." (It might have been any other per cent.) Translated into the kind of situation we deal with in medical investigation, it would read: "This fall in blood pressure, in the patients receiving the new drug, as compared with those not receiving it, could have occurred once in 100 such investigations, due to chance alone, and without any difference whatever in treatment." The figure, whatever its value, whether five or ten in 100 or one in 100 or one in a thousand, is called, in statistical language, "½P," for want of a better name for it. It is the estimated probability that chance alone could equal or exceed the exact difference, both as to magnitude and sign, that constitutes the result of our investigation. If a blood pressure fall is found, it is an estimate of how frequently chance alone could equal or exceed such a fall. With less logic, the statistician usually disregards the sign of the change, and instead of ½P, uses P, twice the estimated probability of a similar or greater fall in blood pressure.

Returning to our shooting contest, we have read the judge's memorandum, but still have not seen his rule for making the decision. Here it is on a page in the student's book:

"If ½P is 2.5 per cent (that is, 5 hits in 200 shots) or smaller, decide against chance. If ½P is larger than 2.5 per cent, throw the case out of court."

The 2.5 per cent, in the rule, is arbitrary, but is agreed on by all experts in this field.

If ½P were ever to be zero for some experimental result, we should have absolute certainty that chance could not cause it and that our decision in favor of the agent employed was correct, but experiments of this kind are seldom performed, indeed, would hardly be worth making. We have to be content with only reasonable certainty in our decisions, something less than absolute, in either managing our daily affairs or in adding to our science.

If ½P is larger than 2.5 per cent, the rule said to throw the case out of court. If larger for our experiment, be we ever so enthusiastic about our findings, they do not prove our new treatment is any better than the old, or that our new endocrine extract is any better than so much salt water. Our findings are, according to the statisticians, to whom we must defer in the argument, not "statistically significant," and we must either abandon the problem or return to our laboratory or clinic and gather more figures to make a stronger case.

Our student has read on, and we find him at a chapter headed "How to Calculate ½P." This turns out to be a sort of cook book chapter, giving a dozen or more examples of common clinical and laboratory problems, with calculations for each. These examples are taken from medical literature and while in most of them the statistical analysis supports the author's conclusions, in one or two the author has concluded a causal connection exists when the rule does not support him, and in one example the author attributes the difference he has found to chance, when the judge would have awarded it to the agent he employed.

This chapter, filled with calculations as it is, is the most formidable looking chapter in the book. We notice the student has scribbled down some figures as he was reading. There is a column headed "deviations," and he has squared the numbers in this column, and later, we see, he has extracted a square root. Some of the figures are labeled. There is one, marked "degrees of freedom," another labeled "standard deviation;" a small letter "t" seems to be important, and, of course, there is our "½P." Over on another sheet he has written the words "chi-square," near a small group of numbers in some ruled spaces, and on another, something about "$(p+q)^n$."

We want to tap him on the shoulder, to ask him about all this. Is it difficult? Can a busy medical student learn it? Is it even worth while to take the time to learn it? It is a pity he cannot answer us, for he would tell us that with cook book directions for everything, and with a worked out example of each common type of problem likely to occur in medical investigation, the figuring is more fearful than painful; that nothing higher than simple arithmetic or the simplest alegbra is involved, nothing more complicated than extracting the square root, and that in his opinion, after six weeks in the laboratory, or six months in the clinic, on a problem, an additional half hour would be sufficient for all the statistical calculations needed. Each of us might want to ask whether the particular type of problem we happen to be working on could be handled in this way, and, again, he would tell us that if the result of our investigation, or any phase of it, can be expressed as a numerical difference, it should be possible to calculate ½P for it.

As the student turns the pages we find a chapter headed, "Associated Agents," and beneath this title we read:

"In an experiment to test the possible effect of some agent, before the result can be attributed to that agent, all other possible causes must be ruled out. These may be termed 'associated agents'."

This, again, is old stuff to us, and any one of us could pass it on to a student. Pain is associated with the injection of some drug; if a physiological effect is observed after the drug is given, we must be sure that it is not due merely to the pain. The patient's expectation of improvement is associated with any treatment given him by a doctor he trusts. This must be ruled out if we are to evaluate correctly the treatment given. Rules and examples are again given in this chapter. We read a rule familiar to us, yet one we have learned from experience, rather than from any book:

"To eliminate associated agents, be sure there is no systematic difference between the two series of measurements or observations as to time of year, place, age, sex, state of activity or rest or emotional state of the subjects, physiological condition, heredity and past history, and none in apparatus, techniques and worker personnel, so far as this can be achieved, with the sole exception that in one series the agent under test is acting, and in the other a similarly administered 'dummy' agent is used."

Several illustrations then follow. The young experimenter is asked to criticize an experiment in which the effect of the removal of an endocrine gland is sought, and in which the operated animal was not compared with another that had suffered a "dummy" operation, but was merely compared with his own previous self. A clinical study is imagined in which the investigator tests out a new treatment of cardiac insufficiency, but rejects certain cases as too far gone to be fair to the new treatment. An experiment is described, in which the effect of the injection of morphine is tested on a group of dogs, and salt solution is injected in another, similar, group for comparison, and in which the experimenter then repeats the test by switching the groups, giving the morphine to the previous salt group and the salt to the previous morphine group, violating, in this second test, the rule that the two groups of animals must not have any consistent difference in their past history.

The student then comes to another rule for eliminating associated agents, less commonly quoted, but one that is designed to eliminate possible diurnal, or other, trends. It reads:

"Never let your control versus your experimental measurements be affected at any point by any regularity in sequence."

Or as the student might put it, "Scramble your observations." A hospital experiment is imagined, in which two treatments are compared, and the suitable patients, as they are admitted, are sent alternately to first the one and then to the other treatment. The student recognizes this regularity of alternation as a violation of the rule, and decides he will toss a coin each time in assigning the patient to the treatment, if he is ever engaged in such a study. An experiment is imagined in which a pharmacologist tries out, in regular order, successively larger doses of a drug, for any progressive difference in effect, and the student condemns it, with the remark: "He didn't scramble them."

A final chapter deals with the material worked on, the dogs, or guinea pigs, or patients. Its purpose is not to make sure that the material in the control series is like that in the experimental, already treated under "Associated Agents," but rather that the material in the two series together does not have some peculiarity that sets these dogs or guinea pigs or patients off as being essentially different from similar animals or people elsewhere—another question of identity, be it noted. The student reads:

"It should be emphasized that when an experiment is completed, and a positive conclusion has been drawn, the conclusion is valid only for material of the kind and condition worked with."

Dogs in Philadelphia may react in a certain way to some test in a nutrition experiment, but dogs in Nashville need not react in the same way. People living in the mountains may react differently to some agent when compared with people living at sea level; work done on female animals may not hold good for males, and it might even be true, in some instance, that a dog with fleas and a bobbed tail might not show the same effect as the one with less fleas and more tail.

This is the end of the student's book. We will hope that his teacher has seen to it that he has studied the examples and learned the rules. He closes his book, and puts it on his shelf, along with the texts of other subjects he has mastered. He has been exposed to a formalized presentation of the rules of evidence in our science—has learned that in the rifle contest, that we call an experiment, there are two official contestants, *Chance* and the *Agent,* and that over in the bushes may be one or more associated agents, not supposed to be taking part in the event, but who may take a shot at the target, if not chased out. That these three contestants are all there is to worry about in any experiment. That by certain general precautions, the associated agents can be excluded from the contest. That the decision that remains is based on the betting odds in favor of chance's success versus failure, ignoring altogether any information about the agent. That these betting odds regarding chance can be calculated for any work the student may do or read about, and, finally, that conclusions are limited to the material dealt with in a study, or material essentially like it.

Our student now has no awe or fear of experimental work, for he has studied a representative number of experimental investigations for their design, and the logic of their conclusions; knows the rules; knows they are simple. In his professional career, he will have the opportunity to make a lasting impression on his science, as well as do service to the individual patient who calls on him for help. He is now better prepared for this opportunity, and, I may say, is thereby better prepared for leadership in his profession.

Who is going to teach him all this? It can be taught by any one of us, for the logic and rules of experimentation are our common property. I have been teaching it, much as I have outlined it, as part of our physiology course at George Washington for many years. We give eight formal lectures—I wish we could spare 16—and about fifteen pages of printed matter. We require the student to analyze statistically half a dozen of his laboratory experiments; and to criticize all his experiments as to their design. It could be taught by the biochemist or the bacteriologist or the pharmacologist, to name a few, or by any staff member in clinical medicine. If by the latter, it could well be given as a seminar, on analysis of articles from current medical literature. I would caution the teacher who is intrigued with statistical methods not to attempt to teach too much. Ours, at any rate, is not a course in statistics, but in the broader subject —the title of this paper, "Experiment Design and Judgment of Evidence."

Report of the Committee of the Association of American Medical Colleges on Changes in Undergraduate Teaching as a Result of the War

Your committee met in Washington, D. C., on April 28, 1942. Present: Dr. Currier McEwen, Dr. H. S. Mustard and Dr. Edwin P. Lehman, Chairman. Commander E. H. Cushing, U.S.N., met with the committee as consultant.

Previous to the meeting the chairman had circularized the deans of all the accredited medical schools and had obtained written opinions from sixty schools, which had been studied by all members of the committee before the meeting. He had also communicated with Lieutenant Colonel Wakeman of the Office of the Surgeon General of the Army, Commander Cushing of the Office of the Surgeon General of the Navy and Dr. J. C. Meakins of McGill University. (Following the formulation of this report it was accepted by Lieutenant Colonel Wakeman as satisfying the requirements of the Army Medical Service.)

On consideration of the data so studied the following report is presented:

I. DEFINITION. Considerable confusion exists in the minds of medical educators in regard to the meaning of the term "military medicine." For the purposes of this report the following two divisions of the term will be employed.

A. *Organizational Aspects:* Those matters dealing with military organization and the life of the soldier as it affects the medical officer. This definition includes customs and courtesies of the service, collection and transportation of the wounded, Army and Navy record forms and returns, drill and command of medical troops, etc.

B. *Professional Aspects:* All strictly medical subjects which become of importance as affecting the health of troops in training areas, on ships, in field operations and in combat. Examples include hygiene and sanitation, venereal disease control, tropical disease, first aid, the surgery of trauma, aviation medicine, etc.

II. Except in those schools with established R.O.T.C. units any effort to teach the organizational aspects of military medicine will be inadequate from the point of view of the military services and will employ time more usefully devoted to medicine proper. Whether or not such training is given in the medical schools, it will have to be repeated after the commission is activated. There are no available Army or Navy officers to give such courses in medical schools except where the R.O.T.C. is already established. In view of changes in the organization of the military establishments in the lapse of years such courses cannot be given by ex-officers of the last war.

It is therefore recommended that no courses on the organizational aspects of military medicine be established for undergraduate medical students. This recommendation is not meant to imply the abolition of such courses already functioning in R.O.T.C. units, or a brief course of orientation lectures in schools which can call on experienced medical officers as instructors.

III. Medical students of all grades of advancement will be employed in various capacities in the event of enemy action in this country whether direct or by sabotage. Except for those with preceding experience, medical students of the first and second years will know less about first aid than many civilian groups now being trained. It is, therefore, urgently recommended that all first and second year students of classes incoming about July 1st be given courses in first aid. Such courses should include at least 12 hours of lectures and practical work covering the ground given in the Red Cross Manual. The course should be given by members of the medical school faculty. It is urged that attendance on this course be required of all students who have not previously had comparable training.

IV. In view of the wide distribution of American troops in the tropics, the problem of tropical medicine is not only of increasing importance to soldiers during the war but also of equal importance to civilian health during and after the war. It is, therefore, recommended that all schools stress tropical medicine within the confines of courses in bacteriology, public health, medicine and surgery. If the curriculum will permit and teaching personnel is available, specific courses in tropical medicine in the clinical years are desirable.

V. The necessity for stressing certain subjects of the professional aspects of military medicine within the frame-work of the present curriculum is recognized. These subjects include the following:

Shock and blood substitutes	Fractures
Soft tissue wounds (including debridement)	Burns
Control of communicable disease	Frost-bite
Prophylaxis and treatment of venereal disease	Sanitation
Cardiovascular disease	Fatigue states
Compression and decompression	Anoxemia
The physiology of high altitudes and dive-bombing	Aeroembolism
Visual adjustments under war conditions	Poison gases
Industrial poisons	Dermatoses and insect bites
Common psychiatric conditions, including modified effort syndrome	peptic ulcer syndrome and

VI. It is recommended that a special course on the professional aspects of military medicine be given to fourth year students, to include any material

listed in Paragraph V which has not been previously given and any new material developing as the result of present war experience, such as the newer treatment of burns, the developments of sulfonamide therapy, immersion foot, blast injuries, renal failure of crush injuries, etc. Such a course may well be expanded to constitute in addition a brief review of many of the topics given in Paragraph V.

VII. It is recommended that each school appoint a special faculty committee to organize and carry out the above recommendations and to assist the medical libraries in making available pertinent current literature.

VIII. It is recognized that the above recommendations mean additions to an already crowded curriculum. Your committee feels, however, that the medical schools have an obligation in relation to the war in which we are engaged which must be fulfilled and that this obligation can most effectively be met by the means proposed. It is suggested that those schools which, on account of available time, find it impossible to organize additional courses, adopt other means of coverage within the confines of their established curricula.

(Signed)

EDWIN P. LEHMAN, *Chairman*
CURRIER MCEWEN
H. S. MUSTARD

Committee on Teaching of Military Medicine

What Medical, Dental, and Nursing Schools May Do to Hasten the Graduation of their Respective Students*

HAROLD S. DIEHL
Dean of the Medical Sciences, University of Minnesota
Minneapolis, Minnesota

War creates demands for all types of medical service far beyond that required by the civilian population in peace times. Physicians and nurses, particularly, are needed in great numbers by the armed services. Colonel Darnall has given you some idea what the needs of the Army for medical officers are likely to be in the near future. Colonel Rowntree has supplemented this with an explanation of the part that the Selective Service system is playing in helping to meet this need. Incidentally, I wish to acknowledge and express appreciation of the splendid and effective cooperation of the Selective Service system in providing for the deferment of military service for medical students.

The available supply of physicians, dentists and nurses is clearly insufficient to meet the greatly increased demands occasioned by the war. Therefore, two courses of action become essential: First, by careful planning we must make the most effective possible use of all available personnel in these fields—the Procurement and Assignment Service has been established for this purpose. Second, we must increase the supply of physicians, dentists and nurses as rapidly as possible. A few individuals are hesitant about increasing the rate of production in these professions for fear that we may have a surplus after the war is ended. Such a point of view, however, has no place in an all out war effort; and it must not deter us from doing everything in our power to meet the medical needs of the country during this national crisis.

To increase the number of physicians, dentists and nurses one obviously must turn to the only source of supply; the medical, dental and nursing schools of the country. To them the question which your program committee asked me to discuss this afternoon is not new because for months they have been considering how they can best serve our country in the critical years ahead.

There are only three ways in which the number of graduates of any college can be increased: First, more students might be accepted for training. This would increase the number of graduates but not until the minimum period of professional training has been completed. In medicine, dentistry and nursing this means from three to four years. Second, the length of the professional training course might be reduced. This would make graduates available earlier but they would be inadequately prepared to render the quality of medical service which the people of this country have come not only to expect but to demand. And, third, professional training courses might be accelerated by eliminating

*Presented before the Sixteenth Annual Meeting of the National Conference on Medical Service held at Chicago, Illinois, February 15, 1942.

vacation periods. This would enable students to graduate earlier than normally without making serious sacrifices in the thoroughness or the quality of their training.

With this general consideration of the problem in mind, let us turn to the possibilities of providing more trained personnel in the shortest possible time in the fields of medicine, dentistry and nursing.

THE ACCELERATION OF MEDICAL EDUCATION

At the meeting of the Association of American Medical Colleges held in October, 1941, two papers were presented, one by Dr. Victor Johnson of the University of Chicago and one by Drs. F. H. Swett and G. S. Eadie of Duke University, on the condensation of four academic years of medical training into three calendar years. To most of the audience the discussion at that time seemed a bit academic; but with our involvement in the war less than two months later these discussions became of immediate and urgent importance to every medical school. In fact, within two weeks after the declaration of war the Executive Council of the Association of American Medical Colleges recommended to its member schools that they adopt a program of medical teaching which would eliminate long summer vacations and accelerate the graduation of physicians.

In making this recommendation the Executive Council was not unaware of the problems and difficulties involved in its accomplishment. It was perfectly clear that there would be financial problems both for the schools and for the students; problems of securing desirable internships for students graduating at irregular periods; problems, possibly, of securing qualified and adequately prepared applicants for the entering classes; problems of maintaining effective teaching staffs and obviously sacrifices of time for research and study. Yet, in spite of all of these difficulties, there was no hesitancy about making the recommendation; because when our country needs doctors we must and will find ways to provide them, difficulties notwithstanding.

The plan of acceleration suggested was to discontinue summer vacations for the duration of the war and to start the academic year of 1942-1943 in the summer instead of in the fall, as usual. This was supplemented by the further recommendation that wherever possible, subsequent classes be admitted at intervals of approximately nine months during the present emergency. This plan will result in the present junior class being graduated three months earlier than normal; the present sophomores, six months earlier; the present freshmen, nine months earlier, and next year's freshman class twelve months earlier than normal. On the basis of 5,000 graduates per year the time gained over the next three years by this accelerated program will amount to the equivalent of one full year's service by 12,500 physicians. That is obviously very much worth while.

The decision as to whether acceleration is possible and the method by which it is to be accomplished was left to each individual school. Yet, it has been reported unofficially that practically all of the accredited medical schools in the United States have already stated that they will accelerate their programs of medical education in accordance with this recommendation.

For the most part, the plans of acceleration fall into two groups. Those institutions which are operating on academic terms of three months each—that is, the so-called quarter or trimester plan—merely move their schedules ahead one term or quarter. Administratively, this is simple, except as it involves conflicts with other classes, such as those of dental and nursing students, which use the same class rooms and laboratories. For institutions which divide the academic year into two semesters of approximately four and one-half months each the difficulties of scheduling a twelve months program are considerably greater. Many of these institutions are planning to divide the calendar year into three terms of four months each. This apparently can be arranged quite satisfactorily although many adjustments of teaching programs and schedules are necessary.

The financial problems of students who are dependent on summer earnings to help finance their medical educations are very real. In my own school, 30 per cent of the students reported that they earned over $200 last summer toward this year's expenses in medical school. Other deans tell me that from one-fourth to one-half of their students are largely self-supporting.

An adequate plan to aid these students has not yet been worked out. Some institutions have loan funds which will take care of the most urgent immediate needs. But it is essential that some plan be evolved and funds provided without delay so that these self-supporting medical students may be able to continue in school under this accelerated program. Consideration is being given to the provision of Federal aid for students in technical fields, such as engineering and chemistry. This is thoroughly sound. Yet, the need for providing similar aid for students of medicine seems just as strong, if not stronger, than for students of engineering. Engineers are needed in war industries. Physicians are needed by the armed forces. In fact, every physically qualified medical student must now apply for a commission in either the Army or Navy. In other words, for the duration of the war the medical schools of this country will be almost exclusively training institutions for medical officers. In view of this, it would seem that the War and Navy departments might provide some subsidy for those students who hold commissions in their respective services. Another suggestion is that the Federal government provide loan funds for medical students. There may be better plans but whatever the method, something needs to be done to aid those students who, because of the discontinuance of vacations, will be unable to earn money which they must have in order to continue their medical training.

The financial problems of the medical schools in connection with the accelerated program are, I understand, being considered by a special wartime commission of the United States Office of Education which is investigating the whole problem of financing accelerated educational programs during the war.

The problem of securing internships for students who graduate from medical schools at irregular intervals will probably not be great because with the loss of second year interns, residents and house officers to the armed forces most hospitals will be able and glad to accept desirable interns whenever they are available.

Any question about having qualified applicants for future medical classes

should be answered by the report that most "liberal arts" colleges are also planning to accelerate their programs. Furthermore, I am convinced that in the case of superior applicants, waivers of certain of the entrance requirements, particularly the time requirement, are thoroughly justified during the present emergency.

Some sacrifices in teaching efficiency and in the conduct of medical research unrelated to the war effort are inevitable. Medical school faculties are suffering losses of their personnel to the armed forces. The accelerated program and larger classes will result in increased teaching loads. The combination can only mean some loss in teaching effectiveness. This, however, will not be serious if the deans and the faculties of the respective medical schools appraise their facilities and limit their efforts to what they can do well.

INCREASED ENROLMENT IN MEDICAL SCHOOLS

Anticipating a need for more medical graduates in connection with the national defense program, the Association of American Medical Colleges recommended to its members approximately one year ago that medical schools which could do so, without sacrificing the quality or standards of medical education, be requested to increase the number of students accepted for the entering class by approximately 10 per cent.

It was not anticipated that many more students could be admitted in accordance with this recommendation because most medical schools were already accepting as many students as their facilities would justify. However, the registration figures for the current year indicate that 356 more students are enrolled in the present freshman medical classes than were enrolled in the classes of a year ago. This increase can probably be maintained in subsequent classes but still larger classes cannot be accommodated without a serious sacrifice in the quality and standards of medical education.

CURTAILMENT OF THE MEDICAL COURSE

Acceleration of the medical curriculum and increased enrolments up to the maximum capacities of the schools can be accomplished without serious sacrifice in the quality of medical training. The same, however, would not be true in regard to curtailment of the medical course. The extent, the complexity and the constant advances of the various medical sciences make the present curriculum inadequate to provide the thoroughness of training which would be desirable. Hence, curtailment of the present program of training would be a serious step backward in medical education. Any proposal that this be done has not, so far as I know, been made. I hope that we will never come to that.

THE ACCELERATION OF DENTAL EDUCATION

The war time quota of dental officers for the armed forces is approximately 1.5 per thousand as compared to a quota of 6.5 per thousand for medical officers. From this it is apparent that the urgency of the need for dentists in connection with the war is not nearly so great as is the need for physicians. In fact, at the present time there are no vacancies in the Dental Corps or in the Dental Reserve Corps of the Army. Yet, for each 1,000,000 men by which the armed forces are

expanded, 1,500 more dentists will be needed. In recent years, there have been approximately 1,750 graduates annually from the 39 accredited dental schools of this country. Hence, there will hardly be enough dental graduates to meet the expanding needs of the Army and Navy.

Of much greater urgency, however, is the need of dental care for the civilian population from which our soldiers and sailors are drawn. Reports of Selective Service examinations show that approximately 100,000 out of each 1,000,000 men examined are being rejected for military service because of dental defects. This is incontrovertible evidence of the inadequacy of the dental care which a large part of the population receives. The reasons for this lack of dental care are largely economic, educational and social. Hence, it does not necessarily follow that an acceleration in the rate of graduating of dentists will improve this situation. It is apparent, however, that more dentists will be needed if more dental work is to be done. Consequently, I am certain that we would all endorse the recommendation made on January 17 by the Council on Dental Education of the American Dental Association that, "accelerated programs be adopted for the period of the war in those cases where dental schools are able to do so without loss in the effectiveness of their work."

The possibilities and the problems of accelerating dental education are essentially the same as those which we have discussed in relation to medical education. In general, the solutions of these problems are the same for both groups. Yet each school has its own peculiar problems which it must solve in relation to local conditions and facilities. It is too early to know what proportion of dental schools will be able to accelerate their programs but doubtless most, if not all of them will find some way of making this contribution to our national welfare.

ACCELERATION OF NURSING EDUCATION

The situation in regard to nurses is quite different. Acute shortages of available personnel in this field have been recognized for some time. In fact, the urgency of the situation led to the passage of a bill by Congress last July (1941) providing $1,200,000 for training nurses for national defense. This fund became available last summer and the responsibility for its administration was placed with the United States Public Health Service.

This fund is being used to assist selected schools of nursing to expand their training facilities for three types of program: (1) the basic undergraduate training of nurses; (2) refresher courses; (3) advanced courses.

Undergraduate Training of Nurses.—The training of nurses in the regular undergraduate program is being expanded with the aid of these federal funds through the provision of additional instructors for the schools and through tuition and maintenance scholarships for students. The amount of such aid for which any school may apply is determined by the increase in the enrolment in that school for the current year over its enrolment for the academic year 1940-1941.

These increases in enrolment are being accepted by the schools in part as larger

classes and in part as additional classes. Some nursing schools which have been in the habit of accepting students only once a year are now admitting two classes a year. The University of Minnesota School of Nursing is now admitting four classes per year instead of two as previously. One of these four classes is limited to college graduates and another to young women who have had two years of college work.

There is no possibility of accelerating the nursing course by eliminating summer vacations because student nurses have never had the three months vacations which have been traditional in other colleges. Nursing educators tell me that some shortening of the course might be possible if the hospital experience of student nurses could be based entirely on educational grounds, without regard to the need for nursing service. Any such shortening of the course, however, would be of little, if any, help in meeting the nursing needs of the country because during the last three to six months of their training student nurses are of practically as much value to the hospital as graduate nurses. Hence, a shortening of the training course for student nurses would require the employment by the hospitals of a corresponding number of graduate nurses.

One of the greatest difficulties in this effort to provide more trained nurses has been the limited number of qualified young women who are applying for such training. Probably the long period of time before they will be qualified to serve as nurses with the Red Cross or in Army or Navy hospitals is a deterrent to many young women who are willing and anxious to serve their country during the war. To overcome this attitude and to point out to them that they are helping to meet the national need for nurses from the day that they begin their training will require constant effort and the use of effective newspaper and radio publicity, speakers and other educational and informational agencies.

Refresher Courses.—In order to bring back into service nurses who have not been practicing their profession in recent years, instructors are being provided by federal funds to work with hospitals in offering refresher courses for such women. A considerable number of such courses, usually of about three months duration, are being offered throughout the country.

Advanced Courses.—Nurses with the capacity and training for leadership are just as essential in nursing as trained officers are in the army. To aid in the provision of such leaders the federal aid program is providing certain schools with qualified teachers and with tuition and maintenance scholarships for selected students to be trained in nursing administration, nursing education and public health nursing.

SUMMARY

Briefly, these are the programs for the acceleration of the training of physicians, dentists and nurses. There are still problems to be solved to make these programs function effectively, but the schools of medicine, dentistry and nursing are putting them into operation with confidence that the difficulties will be met and with a determination to make these programs a success.

Skeletal Muscles
Morphologic Considerations for the Medical Student

CHARLES F. DE GARIS
Professor of Anatomy, University of Oklahoma School of Medicine
Oklahoma City, Oklahoma

Among medical students it seems generally agreed that in cumulative effect muscles comprise one of the most formidable systems in human anatomy, because, in the first place, they are too numerous even to name, except as they fall into morphologic groups; in the second place, they are customarily presented in a maze of minor details. The student who seeks to learn (or shall we say to memorize?) muscles, one by one, as to origin, insertion, nerve supply and action, soon finds himself overwhelmed with disconnected facts, and must realize that the task he has set himself is a hopeless one. Yet he should and can learn much about muscles if he acquires certain broad concepts and works out a continued story from its logical beginning, viz., development. The present discussion, then, is a brief outline of the first chapter, designed to show the student the budding grove before he essays to examine the detailed verdure of the trees.

Such a picture of muscles in perspective must cover a wide range: the apparent relation of muscle to nerve, the somatic series and serial homology, the limb muscles and inverted homology, the branchiomeric series and the system of branchial arches. These varied elements compose a study in chiaroscuro on a central theme, the genesis of skeletal muscles, which latter will now be examined in their several categories.

On either side of the neural tube in the vertebrate embryo there is a repetitive series of mesodermal somites, from the muscle plates (myotomes) of which are developed the somatic type of skeletal muscles. The branchiomeric type peculiar to the head region will be seen to have a different source.

The dorsal and ventral borders of the muscle plates form rapidly growing points, which become extended into epithelial-like sheets. A dorsolateral sheet, derived from the dorsal borders of the muscle plates, comes to overlie the neural tube on the dorsum of the embryo, and gives rise to the intrinsic muscles of the back. A ventrolateral sheet, derived from the ventral borders of the muscle plates, invades the somatic mesoderm of the body wall and forms the lateral and ventral muscles of the wall, also the prevertebral muscles of the neck.

In this connection, it is necessary to discuss, at least briefly, the question of nerve-muscle relation, since it is on this relation that the present account largely rests. (Paterson (1887), Fuerbringer (1888) and many others have held that the nerve supply of a premuscle mass is established at a very early stage, and that

accordingly the nerve of a given muscle becomes a reliable guide to its developmental history. Against this concept of the nerve-muscle as a single protoplasmic unit are the observations of His, Cajal, Harrison, Speidel and others that the nerve fiber can be found as an independent protoplasmic outgrowth from the cerebrospinal axis. Also Bardeen (1907) and Lewis (1910) have reported that the muscles differentiate before their nerve supplies reach them. This is clearly at variance with the "Fuerbringer hypothesis."

Thus, there are two contending and apparently incompatible views on the nerve-muscle relation. That held by Paterson, Fuerbringer et al postulates a continuity between nerve and muscle from the very early history of each, the muscle drawing the nerve with it wherever it migrates. "This view is so simple and from everyday experience so self-evident that one is reluctant to dismiss it. The other view, which holds that the muscles develop first and then the nerves grow to them, involves at once the large contingency of proper nerves invariably growing to proper muscles, a sort of intuitive seeking out of muscles by growing nerves, as it were a tropism or chemotaxis, which, at best, leaves one with a discomforting sense of some occult transaction." (Chase and De Garis, 1940, p. 250). Even those who criticize the Fuerbringer hypothesis most sharply, e.g., Cunningham (1891) and Haines (1935), agree that the nerve supply, though not an invariable guide, is often an important and very useful one in settling questions of homology.

Accordingly, and with reservation, we shall proceed on the formula that whence comes the nerve so came the muscle. But this is not to imply that every muscle is traceable to a single muscle plate. A few groups of muscles are, but by far the greater number derive from fusion of two or more myotomes. As muscles grow, they may, and often do, become far removed from the skeletal parts with which they were first associated as somatic derivatives. One of the most striking examples of muscle migration is the diaphragm, which began its development in the midcervical region, therefore was, and continues to be, supplied by cervical nerves 3, 4 and 5. Likewise, muscles arise from the limb buds and spread to remote parts of the axial skeleton for final attachment—as, witness, the latissimus dorsi, pectoral muscles, and in many mammals the panniculus carnosus. Yet, wherever these vagrant muscles go, they remain true to their original nerve supply; to all appearance they carry their nerves with them.

TRUNK MUSCLES.—The dorsolateral sheet, as it wanders to the dorsum of the embryo, carries with it the dorsal primary divisions of the spinal nerves and forms a longitudinal muscle column on either side of the neural tube and its developing skeletal encasement. This longitudinal muscle column eventually is split by linear fibrous septa into the various series of intrinsic back muscles. The deepest parts of the dorsal borders of the muscle plates do not form a sheet but in certain regions of the axis remain discrete and become the interspinales and rotatores.

The ventrolateral sheet carries with it the ventral primary divisions of the spinal nerves, and as it invades the somatic mesoderm of the body wall it breaks up into three parts. (1) The dorsal part forms a prevertebral muscle column which persists as the longus colli, longus capitis and the crura of the diaphragm. (2) The ventral part eventually forms a precelomic muscle column, which gives rise to the rectus abdominis, pyramidalis, sternocostal part of the diaphragm, the infrahyoid muscles, the geniohyoid and to all appearance a variable sternalis muscle. (3) The intermediate part becomes trilaminate, and in the abdominal region forms the obliquus externus, obliquus internus and transversus; dorsally it remains unlaminated as the quadratus lumborum, this latter representing lumbar segments 1 to 4. In the thoracic region the one fused muscle is the deepest—the transversus thoracis; the other two laminae remain segmental as the external intercostals and levatores costarum, the internal intercostals and subcostals. In the cervical region some of the ventrolateral sheet has disappeared, some persists in trilaminate form as the scalene muscles, some as part of the diaphragm. In the sacral region the upper myotomes disappear; only the third and fourth sacral myotomes persist, forming the levator ani and coccygeus, which muscles are primitively tail movers and in their definitive state retain their connection with the tail skeleton (coccygeal vertebrae). The muscles of the urogenital triangle and the anal sphincters are differentiated from the primitive sphincter of the cloaca.

The third part of the ventrolateral sheet, mentioned above as trilaminate, affords an excellent example of segmental nerve supply and serial homology. The typical distribution of a spinal nerve is to the musculature directly caudal to it. This simple relation is preserved between intercostal (thoracic) nerves and intercostal muscles, each nerve passing around the thorax under the lower border of the rib and supplying the muscles just caudal to it, i.e., the external and internal intercostal muscles of its own space. In the dorsal part of its course the nerve enters the interval between these two muscles, then near the midaxillary line it passes deep to the internal intercostal muscle and lies first against the parietal pleura and farther forward between the internal intercostal and transverse thoracic muscles.

Such, at least, is the typical course of the upper six intercostal (thoracic) nerves. The lower six nerves of this series continue to supply the sharply diminishing extent of intercostal muscles in their respective spaces, but where these spaces end at the truncation of the lower thoracic aperture, the nerves continue beyond the intercostal spaces to supply the abdominal muscles. So, quite literally, it must be said that the abdominal muscles are an extension of the thoracic muscle sheet, with contributions from the first lumbar and in small part the second lumbar myotomes. Accordingly, the nerve supplies of the abdominal muscles are T7 to 12, L1 and to some extent L2. These nerves pass around the trunk in the interval between the internal oblique and transverse muscles, just as the upper six thoracic nerves come to lie between the internal intercostal and transverse thoracic muscles.

Likewise, in the cervical region the scalene muscles maintain a trilaminate relation to the cervical nerve roots, these latter forming the cervicobrachial plexus. The anterior scalene lies directly anteromedial to the nerve roots, the middle and posterior scalenes lie directly posterolateral. So it becomes apparent that the anterior scalene corresponds to the first or dorsal part of the internal intercostal muscles, the middle scalene to the external intercostal muscles and, apparently, the posterior scalene is in series with the levatores costarum.

Aside from the consistently trilaminate arrangement of these ventrolateral muscles and their relations to the segmental nerves, the outstanding fact to bear in mind is that the abdominal musculature is, in very large part, derived from thoracic myotomes. There is an ever increasing downward slope of the spinal nerves, and just as the trunk grows faster and farther caudally than the spinal cord (producing the cauda equina), so the muscle sheets grow downward from their thoracic sources to attach to the pelvic skeleton. In this way the abdominal muscles (mainly thoracic somite derivatives) bridge the interruption in the lumbosacral series of somites, which interruption is due to the lower limb buds drawing off the mesenchyme and spinal nerves of the lumbosacral series. It is seen that the spinal nerves not fully represented in the skin and muscles of the trunk, i.e., L1 to S2, are precisely the nerves which form the lower limb plexus. Likewise, the spinal nerves not fully represented in the skin and muscles of the upper trunk, i.e., C5 to T2, are precisely the nerves which form the upper limb plexus.

MUSCLES OF THE EXTREMITIES.—From the mesodermal core of the limb buds there is an early differentiation of anterior and posterior muscle sheets in relation to the developing skeletal elements. The spinal nerves supplying, or destined to supply, the limb muscles are, in the first place, entirely ventral primary divisions (dorsal primary divisions supply only the intrinsic muscles of the back); in the second place, these ventral primary divisions lose their segmental character by forming the trunks of plexuses; in the third place, these trunks break up into anterior and posterior components, which are distributed respectively to the anterior and posterior muscle sheets of the extremities or to the derivatives of these sheets.

Although there has been much speculation as to the segmental nature of the limb muscles, the most we can say is that the muscles which develop along the pre-axial border of the extremities are supplied by the highest nerves of the plexus, while those which develop along the post-axial border are supplied by the lowest nerves of the plexus (Herringham, 1886). The same holds for the nerve supply of the skin, e.g., of the upper extremity, which enables us to say that "if the pre-axial margin is followed down the arm to the hand, around the hand and up the post-axial margin, the cutaneous nerve supply thus covered will be in a graded series down the brachial plexus." (De Garis, Lachman and Chase, 1939, p. 119).

The upper and lower extremities are, save for their girdles, remarkably

similar in ground plan, though this similarity is more or less masked by certain postural and functional differences. The upper extremity subserves the very versatile functions of manual dexterity, while the lower extremity loses in versatility what it gains in massive structure for support and locomotion. The following structural differences point up these functional differences: (1) the widely mobile pectoral (shoulder) girdle vs. the relatively fixed pelvic girdle; (2) the pronating-supinating radius vs. the nonrotating tibia; (3) the biaxial (condyloid) wrist joint vs. the uniaxial (ginglymoid) ankle joint; (4) the freely opposable thumb vs. the normally limited great toe. It should be noted, however, that the multiaxial talo-calcaneo-navicular joint has no counterpart in the carpus. Also mention should be made of cases where loss of upper extremities or loss of their dexterity has been compensated by the lower extremities, especially through adaptation of the feet, which latter acquire astonishing versatility in executing such complicated acts as writing, typing, needlework and other functions usually attributed only to manual dexterity. The feet, then, must be viewed as having large potentialities, which normally they are not called on to display.

The postural differences of the upper and lower extremities are very striking. If we consider, as we must, that the thumb and great toe are homologous, then it is seen that with the arm in anatomical position (palm forward, forearm bones uncrossed) the thumb is lateral, whereas with the leg in anatomical position (sole backward, leg bones incapable of being crossed) the great toe is medial. So, too, the radius, always on the thumb side, is lateral, whereas its homologue, the tibia, always on the great toe side, is medial.

Extending the comparison to the thigh, it is seen that the quadriceps muscles, homologues of the posteriorly placed triceps, are on the ventral aspect of the thigh, while the hamstring muscles, homologues of the anteriorly placed biceps group of the brachium, are on the posterior aspect of the thigh. The nerve supplies of these muscles will complete the story. Thus the supply of the quadriceps is the femoral nerve, a posterior derivative of the lumbar plexus, just as the supply of the triceps, the radial nerve, is a posterior derivative of the brachial plexus. In like manner, the supply of the hamstring muscles (except the short head of the biceps) is the tibial nerve, an anterior derivative of the lumbosacral plexus, just as the supply of the biceps brachii, the musculocutaneous nerve, is an anterior derivative of the brachial plexus.

A further point-for-point comparison would show that the lower extremity has, in fact, rotated medially from its primitive limb bud position (great toe toward head) through a complete semicircle (180 degrees), so that the great toe is medial, the original posterior aspect of the extremity is anterior, the original anterior aspect is posterior. So according to skeletal elements, muscles, nerves or any other components we may choose, we find in the comparison of upper and lower extremities an excellent example of what we have termed "inverted homology."

This type of homology as applied to the limb muscles may now be tabulated as follows (omitting here the dubious homologies of the girdle muscles):

UPPER EXTREMITY		LOWER EXTREMITY
Coracobrachialis	=	Adductor group of thigh
Triceps	=	Quadriceps group
Biceps-brachialis	=	Hamstring group
Flexores carpi ulnaris et radialis	=	Gastrocnemius
Palmaris longus	=	Plantaris
Flexor digitorum sublimis	=	Soleus and flexor digitorum brevis
Pronator teres	=	Popliteus
Flexor digitorum profundus	=	Flexor digitorum longus
Flexor pollicis longus	=	Flexor hallucis longus
Brachioradialis, extensores carpi radiales longus et brevis	=	Tibialis anterior
Extensores digitorum communis et digiti quinti proprius	=	Extensor digitorum longus
Extensor carpi ulnaris	=	Peroneus longus et brevis

In the above listing it will be seen that the tibialis posterior, quadratus plantae and extensor digitorum brevis of the lower extremity are not assigned homologues in the upper extremity. The intrinsic muscles of hand and foot afford the most obvious homologues, which lead to the further conclusion that the ulnar nerve corresponds to the lateral plantar, the median nerve to the medial plantar, with the ulnar-median above the wrist represented above the ankle by the undivided tibial nerve. Likewise, the common peroneal corresponds to the radial in its forearm course. The radial in the upper arm, supplying the triceps-anconeus, is represented by the femoral nerve to the quadriceps group. The entire obturator nerve would have its counterpart in the seventh cervical supply to the coracobrachialis; the tibial to the hamstring muscles would be represented by the musculocutaneous to the biceps-brachialis. Muscles having dual nerve supply, e.g., the pectineus, adductor magnus and biceps of the thigh and the brachialis of the upper arm, are only accountable in this system of homologues on the assumption that such muscles develop from dual sources. Also, it should be said that the foregoing list of homologues is but one of several, some of which undertake to compare the pectoral and pelvic girdles and their musculatures.

MUSCLES OF THE HEAD.—In the head region, the repetitive series of somatic muscles is represented near the apical part of the embryo by three cephalic myotomes, which give rise to the extrinsic muscles of the eye, these muscles being supplied by the three forwardmost somatic cranial nerves, viz., the 3rd (oculomotor), the 4th (trochlear) and the 6th (abducens). Far removed from these cephalic myotomes are the three or four occipital myotomes, which fuse to form the muscles of the tongue (intrinsic and extrinsic), their supply being by the only other somatic motor cranial nerve, the 12th (hypoglossal).

In the large expanse of head region, between cephalic and occipital myotomes, there is another repetitive series peculiar to the head, viz., the series of branchial arches, which are, as it were, superimposed upon, or interposed between, elements

of the somatic series. The branchial series is regarded as comprising six arches, but in the mammalian embryo the caudalmost or ultimobranchial arches must be treated with a degree of uncertainty. However, certain it is that very many important features of head and neck anatomy are traceable to the branchial arch series, more often than not to individual arches. In the present discussion, our attention must be confined to the muscles and skeletal elements which arise from or form these arches and to the characteristic nerves of the arches, which will serve largely as our guides. Between the arches are branchial clefts externally, branchial pouches internally, and from the marginal mesoderm of these clefts and pouches are derived, among other things, certain groups of muscles. Because of their derivation these muscles are, as a class, termed branchiomeric. Let us see how much of a connected story can be made of the branchial arches, their skeletal elements, muscles and nerves.

Most of the branchial clefts and pouches, as such, disappear during development, but not so the first cleft and pouch. The first cleft persists as the external auditory meatus; the first pouch persists as the greater part of the middle ear and the auditory (Eustachian) tube, which latter connects the middle ear with the nasopharynx. The invaginations or clefts and the evaginations or pouches, with which we are dealing here, are often termed pharyngeal clefts and pouches, so it is highly proper that the persisting first pouch should communicate with a part of the pharynx. But it must not be supposed that the first cleft and pouch at any point form a continuous opening comparable to a gill slit. Cleft and pouch do come very close together in the ear, where they are separated only by the tympanic membrane, the outer layer of which is contributed by the cleft, the inner layer by the pouch. So the tympanic membrane (ear drum) is quite literally a branchial cleft membrane.

Having the above facts in mind, we might with reason expect some of the marginal musculature of the first pouch to persist in primitive relation to the auditory tube. And so it does. Directly above the tube, in a semicanal of its own, is the tensor tympani muscle, whose tendon is directed backward and laterally to the malleus, one of the various skeletal elements of the first arch. And directly below the tube, especially its cartilaginous portion, is the tensor veli palatini muscle, whose tendon is directed forward and medially to the soft palate. If these two muscles are supplied by the same cranial nerve, then we are justified in concluding that we have found the characteristic nerve of the first branchial arch. And this we have; both muscles are supplied by the motor division of the 5th cranial (trigeminal) nerve.

But there is much more to the first branchial arch than is represented by the distribution of these two muscles. The largest skeletal element of the first arch is Meckel's cartilage, around which develops the mandible. Then, if the 5th cranial nerve supplies any other muscles, we would expect such muscles to be more or less intimately related to the mandible. This is the case; the 5th nerve on each side supplies six other muscles, viz., the group of four muscles of mastication, the mylohyoid and the anterior venter of the digastric, and all six muscles

are attached to the mandible. So it is seen that the first branchial arch and its cleft and pouch form an exemplary point of departure for the story, because they fulfill all our expectations.

The second branchial arch is not so explicit in the finished mammal, but none the less, it does bear out our story. The pouch associated with this arch forms by its upper posterior segment a part of the middle ear, by its lower anterior segment the fossa of the palatine tonsil (sinus tonsillaris). One of the ear ossicles, the stapes, is part of the skeletal structure of the second arch. To the stapes is attached a tiny muscle, the stapedius, whose nerve supply is the characteristic motor nerve of the second arch, viz., the 7th cranial (facial). Besides the stapes, the skeletal structure of the second arch comprises the styloid process, the stylohyoid ligament (sometimes completely ossified), the lesser cornu and upper part of the body of the hyoid bone.

If the second pouch should persist more extensively than to form part of the middle ear and tonsillar fossa, then there would be a fissure or, possibly, a cyst passing from the middle ear forward and medially toward the hyoid bone. And the primitive marginal musculature of the pouch should lie on either side of the fissure or cyst. Also, to complete the story, such musculature should be supplied by the characteristic nerve of the second arch, the 7th cranial (facial). These conditions are met as a congenital anomaly. A fissure or cyst is sometimes found in the region of the second arch, where it lies above and in front of the posterior venter of the digastric muscle, below and behind the stylohyoid; both these muscles are supplied by the facial nerve and both attach to the hyoid, specifically to that part of it forming a skeletal element of the second arch.

But it may be objected that the facial nerve supplies an extensive array of muscles, those of the face and scalp, which are in no way connected with the hyoid or any other element of the second arch. This is precisely what it does; it even supplies the platysma, which lies just beneath the skin of the neck and the uppermost part of the thorax. But all these far flung muscles of the facial area had their humble origin from the second arch near the base of the styloid process. They have migrated downward over the neck and thorax, forward over the face, upward in front of the ear, backward behind the ear. Yet, vagrant as these muscles are, they have in every instance retained the nerve supply which characterizes the second arch; they have carried with them branches of the facial nerve whose trunk emerges from the skull directly behind the styloid process, i.e., from the stylo-mastoid foramen. A clearer illustration of the Fuerbringer hypothesis would be hard to find.

The third branchial arch is crowded closely beneath and behind the second arch. Its skeletal elements are the lower part of the hyoid body and the entire greater cornu; its characteristic nerve is the 9th cranial (glossopharyngeal); its muscles are the stylopharyngeus and the upper constrictors of the pharynx. Of the third cleft nothing normally remains; of the third pouch the most conspicuous remnant is the recessus piriformis on either side of the superior aperture of

the larynx. As a possible remnant may be mentioned the interval between superior and middle constrictors of the pharynx, through which interval passes the stylopharyngeus muscle.

The fourth, fifth and sixth branchial arches tend to lose their individuality in the formation of the uppermost part of the separate respiratory tract, namely the larynx. "Even in mammals the cartilages of the last three branchial arches remain subservient to the purposes of respiration, just as in vertebrate animals in which these arches carry gills." (Keith, 1933, p. 280)

A much simplified analysis of the remains of these arches is as follows: The skeletal elements of the fourth arch are the epiglottic cartilage and the upper part of the thyroid cartilage; the muscle derivatives have, in large part, wandered upward to form constrictors of the pharynx and muscles of the soft palate; in small part, they have remained intrinsic to the larynx as the crico-thyroid muscle. The characteristic nerve of all three lower arches is the vagus-accessory complex, of which the superior laryngeal branch of the vagus is indicated as specific for the fourth arch.

The fifth arch has as its skeletal element the lower part of the thyroid cartilage, as muscle derivatives all the intrinsic muscles of the larynx (except the crico-thyroid), and as specific nerve supply the inferior (recurrent) laryngeal branch of the vagus. The fifth branchial pouch is probably and, in part, represented by the laryngeal ventricle and its appendix.

It is of much interest to recall the peculiar relations which are maintained between the nerve of the fifth branchial arch (inferior laryngeal nerve) and the fourth arterial arch. The branchial arches are at early stages accompanied by arterial arches, some of which are very transient, the upper ones, for the most part, having vanished even before the lower ones appear. The fourth arterial arches, however, persist, on the right side as the proximal part of the subclavian artery, on the left side as the aortic arch. Now since the nerve to the musculature of the fifth arch does in early stages lie in a plane caudal to the fourth arterial arch on either side, it must pass below the arterial arch to reach its termination in the muscles of the future larynx. Nor is this relation altered when the fourth arterial arches are eventually drawn downward by descent of the viscera to levels much below the larynx. The nerve to the fifth branchial arch on each side is also drawn downward by means of and caudal to the persisting fourth arterial arches, with the final result that on the right side the inferior laryngeal nerve has to pass under the subclavian artery and then recur upward to the larynx, while on the left side it has to pass under the arch of the aorta and recur even farther to reach the larynx. Hence, the inferior laryngeal or 5th branchial arch nerve is often and properly termed the recurrent laryngeal branch of the vagus.

To the sixth arch are attributed the cricoid and arytenoid cartilages, and by some authors even the tracheal cartilages (Frazer, 1931). The derivative muscles and specific nerve of the sixth arch are matters of unsettled opinion, and need not detain us here.

Thus, in closing, we have accounted for all the branchiomeric muscles except the sternocleidomastoid and trapezius. That these two muscles have arisen from the region of the lower arches is indicated by their accessory nerve supply. That they have migrated far from their branchial source is shown by the fact that both attach to the skeleton of the upper extremity (clavicle and/or scapula); also, one of them, the trapezius, covers the intrinsic muscles of the back from superior nuchal line to 12th thoracic spine. The interval between trapezius and sternocleidomastoid, forming the posterior surgical triangle of the neck, is, in fact, a depression, and strongly suggests a branchial remnant with typical anterosuperior and posteroinferior muscle margins. It is tempting to assign these two muscles to the sixth arch and to regard their accessory supply as the specific nerve of the arch. However, the only ground of observation supporting this view, at least as applied to man, is the infrequent occurrence in the posterior triangle of certain cystic structures, congenital and apparently branchial in origin.

From what has been said of the branchial arch system it is seen that the finished mammalian head and neck form, as it were, a reliquary containing numerous and sundry fragments of a momentous period in developmental history, momentous because during this period the embryo emerges from a generalized vertebrate state to one expressing the individuality of a given genetic constitution. It is the period when ontogeny ceases to repeat phylogeny (if it ever did), and the developing organism is at long last able to say a few words of its own as to its future morphology. The fragments left over from the early state have been variously interpreted by a host of workers in comparative anatomy and embryology. The account given here is but one of many on this engrossing subject, and should be accepted merely as a working hypothesis whereby the anatomy of the head and neck may be rationalized to a considerable degree.

LITERATURE CITED

Bardeen, C. R.: Development and variations of the nerves and musculature of the inferior extremity and of the neighboring regions of the trunk in man. Am. J. Anat., 6:259-390, 1907.

Chase, R. E. and DeGaris, C. F.: The brachial plexus in Macacus rhesus, compared with man. Am. J. Phys. Anthrop., 27:223-254, 1940.

Cunningham, D. J.: The value of nerve supply in the determination of muscular homologies and anomalies. J. Anat. & Physiol., 25:31-40, 1891.

De Garis, C. F., Lachman, E. and Chase, R. E.: Principles of Human Anatomy, with Synopses and Bibliography. 1939. Philadelphia.

Frazer, J. E.: Manual of Embryology. 1931. London.

Fuerbringer, M.: Untersuchungen zur Morphologie und Systematik der Vögel. Amsterdam. 1888.

Haines, R. W.: A consideration of the constancy of muscular nerve supply. J. Anat., 70:33-55, 1935.

Herringham, W. P.: The minute anatomy of the brachial plexus. Proc. Roy. Soc., 41:423-441, 1886.

Keith, A.: Human Embryology and Morphology. 1933. Baltimore.

Lewis, W. H.: The Development of the Muscular System. Keibel and Mall, Manual of Human Embryology, I. 1910. Philadelphia.

Paterson, A. M.: The limb plexuses of mammals. J. Anat. & Physiol., 21:611-634, 1887.

Teaching Preventive Medicine to Undergraduate Medical Students*

WM. HARVEY PERKINS
Dean and Professor of Preventive Medicine, Jefferson Medical College
Philadelphia, Pennsylvania

The problem of the content of a course in preventive medicine arises perennially, particularly when the discussion of it is limited to undergraduate teaching.

The reason that this remains a problem seems to be due to the apparent necessity for thinking in terms of a course. This is not only unnecessary, but it is not true. Any attempt to hem in an idea into few or many crowded hours is entirely impossible for the reason that prevention itself cannot be encompassed in any restricted segment of the study of medicine.

Preventive medicine is not a specialty. It is not public health. It is not hygiene or sanitation or administration. It is all of these and other aspects of the prevention and control of disease, but beyond all of them it is a philosophy and a science having practical application in every phase of medicine.

Any hours in the curriculum that may be assigned to preventive medicine can be no more than so many hours devoted to accentuation of the possibilities in prevention and to a study of a few technics and special branches of knowledge that can be applied to prevention.

The difficulties in presenting prevention of disease to undergraduates has been due, in no small part, to the historical carryover and emphasis on public health. To the undergraduate, this is dry stuff. The kind of public health taught and practiced too long can be best described as "pit-and-privy" practice. It is not intended that this should be taken as a criticism of public health today but rather as a seriously meant harangue against too literal interpretation of public health aims and purposes by a few teachers of undergraduate students who could think no farther than sanitary gadgets.

Without placing any blame on those who have shown the way in the methods of teaching preventive medicine, it has been a disadvantage that preventive medicine has been so long considered synonymous with public health. And it is unfortunate, too, that public health has had as its outstanding connotation the special technics of sanitation, sewage disposal, quarantine and statistics. It is unfortunate because these things are but a part of the whole meaning of the term. Public health, like preventive medicine, is a term far broader than the mere words imply, and connotes a methodology filled with romance and potentialities that can be found in few other branches of medical practice.

There is one further important block standing in the way of putting preventive medicine across to the undergraduate: in every other preclinical and

*Read at the meeting of the Southern Branch of the American Public Health Association held in St. Louis, Missouri, in November, 1941.

clinical study in which he has been engaged, the young student's mind has been bombarded with considerations of the individual. He has been taught most emphatically to think in terms of the individual, and a sick one too, with only an occasional reminder that the person is one of many persons, a family, a student body, a community, or, even more rarely, a herd. As a result, there develops in him a positive aversion to thinking of man enmasse, particularly a mass of people who are not even sick! To attempt in a few allotted hours to interest students engrossed with sick individuals in the problems and methods of public health is to ask for just that enthusiasm that this kind of teaching has earned.

It has become increasingly apparent that the teaching of public health, and/or preventive medicine, can be done satisfactorily only if the approach to it is prepared by other teachers in the medical school. This does not mean a revolution in the present curriculum but it may amount to a minor revolution in the thinking of many who teach in it.

There can be no excuse for any clinical teacher not to think, at least part of the time, in terms of the prevention of the diseases he is discussing. Nor can those in the preclinical sciences ignore the broad aspects of man as a biological organism immersed in an environment that is sometimes malignant and always benign. Throughout the curriculum, interest in man and human ecology can be inculcated into the student so that he no longer visualizes disease as limited to the diseased person or thinks of health in negative terms as absence of disease. All prevention rests on these concepts, and the student who is unfamiliar with them, through constant repetition in every subject he studies, is unprepared for the special methods of preventive medicine and public health.

It must be conceded that the student's interest and that of his clinical teachers always has been and probably always will be centered around the sick person. The word "patient" has been the core of all medical thinking and the patient is an ill individual. The well person, as a result, has lain outside the interests of medicine in general and has remained the special prerogative of the public health-minded. It is interesting to see the trend today in which the clinician is beginning to appreciate the significance of community living on the cause and course of disease. And the public health worker is concerning himself more and more with the health of his public as affected by such non-public conditions as cancer and diabetes.

Therein lies the opportunity today to teach preventive medicine with living every-day interests; to center it in some way around the present, most significant factor in medical practice—the patient.

Studies of the methods of instructing undergraduates in preventive medicine show that out of the wide experience of many experimenters in pedagogy there is slowly coming about a crystallization of thought—that preventive medicine must maintain contact with clinical medicine at all points. Even the remote part sciences of sanitation and public health administration must point to and touch the object of their solicitude—the individual who is sick or who may become sick:

not a hypothetical person on a chart but, for the undergraduate student, a particular person who is, has been, or is in the position of becoming involved in disease.

This means ward and clinic teaching by someone in the Department of Preventive Medicine or to use the more restricted term, Department of Public Health. It is immaterial whether the portion of the faculty on whom the responsibility is placed be a separate department or a division of a department. This is still largely a matter of expediency in every institution. Nor is it of too great importance which department or division undertakes the obligation, although it is more logical to place it in some than in others.

Because of the newness of preventive medicine in the curriculum (although it has been there in some instances for several decades), the optimum condition would be to set it up in a separate department; or, next best, as a division of the Department of Medicine. The main criterion is that it should be a clinical branch. General medicine is better than any clinical division of medicine because of the undesirable connotations that quickly attach themselves to subjects taught in the specialties. Under no circumstances should it be relegated to the preclinical branches where there is no, or insufficient clinical contact.

The Head of the Department or Division may be a specially trained public health man or a general medical clinician. If he is the former, he must have a clinician of professional caliber on his staff; if he is the latter, he must have with him or have the teaching services of a man trained in the special interests and technics of public health. It must be kept in mind that the term "public health" as used here means public health in all of its aspects—epidemiology, biostatistics, public health administration and sanitation; (industrial, mental and school hygiene, too, if you will).

The clinical touch can be obtained if the three prerequisites found in every four year school of medicine are utilized—clinic and ward patients, a clinician, and relatively small groups of students.

It will be assumed that the Department (let us concede it is a department) of Preventive Medicine has students assigned to it for a reasonable period of time—say, part of a day each day for the greater part of a month or one whole month. In this time, the department will utilize patients in the wards or clinic as the cornerstone of teaching. There can always be found some patients who present conditions that could have been prevented; others who involve relatives, friends or contacts in circumstances with epidemiologic interests; some with problems of personal hygiene and applied prophylaxis; instances of contact or industrial poisoning; examples of faulty inheritance; mental hygiene problems; and patients coming from poor environments.

The optimum use of such patients will come from ignoring them as clinical "cases" and utilizing them as foci of influences and circumstances of which they are the victims. Analysis of these factors points the way to the prevention and control of disease and the maintenance of health. The greatest use of them can

be obtained through the seminar method. At these seminars will be present other staff members, teachers of preclinical subjects, social workers and others who may be interested in the problems to be brought up. For example, should the case be one of faulty nutrition—the clinician, physiologist, dietitian, social worker and home economist would all be interested and should be capable of participating in the analysis and solution of the problem. If the patient were a case of typhoid fever on a ward—the clinician, epidemiologist, laboratory worker and sanitary consultant would be the appropriate participants.

Such teaching cannot be haphazard. The responsible teacher must have a program outlined in advance. In it he will plan demonstrations of cases representing examples of each major group of causative factors that may result in disease—inherited, nutritional, intoxications, infectious communicable diseases, intestinal parasites, accidents and disorders of behavior and maladjustment, if his staff is prepared to undertake this.

Should the time allotted him permit, he may well collaborate with special departments, such as gynecology, obstetrics and pediatrics on common problems of prevention. Discussion should be guided so that every consideration will have a bearing on the cause and prevention of the condition; it should not be permitted to become just another clinical conference.

From the nature of the material used and the fact that a sound knowledge of the clinicopathologic conditions of these patients is necessary to a broad understanding of the etiologic significance of the problems discussed, it appears that this teaching should be limited to the students of the fourth year class.

Epidemiology is one of the valuable tools of preventive medicine and its principles should be taught to every medical student. The place in the curriculum where it appears to fit best is in the second year when students have just finished or are completing their studies on the agents of disease in bacteriology and parasitology, pharmacology and applied physiology, and have had instruction in serology and immunology. The epidemiologist on the staff would correlate his teaching with these subjects and utilize examples gleaned locally, so far as possible from his own experiences in the department or from the local health department.

In the third year, reliance must be placed largely on a well organized series of lectures on special problems in prevention—tuberculosis, venereal disease, typhoid fever, parasites, etc. These will be personalized again on the clinical level in the work of the fourth year.

The difficult problem of teaching sanitation, water purification, public health administration and other special public health technics in an interesting way can be solved by showing the part they play during the work in epidemiology and in the practical application to cases in the fourth year. The question whether to utilize the field visit or not would seem best to be left to the discretion of the teachers in each institution. It must be admitted that in this country they work well in some instances and in others are a gross waste of everybody's time. If

they cannot be done well, logically and with direct reference to other aspects of the course, they should not be done at all. Sanitary surveys, theses and the like come in the same category.

There remains the problem of biostatistics. This may not be the primary responsibility of a Department of Preventive Medicine but in the general neglect of instruction to undergraduates in the use of the statistical method this may be the place for it because of its special application in epidemiology and vital statistics. If given at all, it should be in the first year of medicine. It is a scientific tool and the use of it cannot be learned too soon. In a short practical course the student may learn the significance and use of birth and death reports, to compute rates and what is highly desirable, become accustomed to analyzing clinical reports and tabulations in the literature for their completeness, accuracy and significance.

The hours allotted to the teaching of preventive medicine under such a plan as this mean little; it is today largely a question of disseminating the teaching throughout the curriculum so that the subjects taught correlate logically with related clinical and preclinical subjects.

The framework herein presented is as flexible as the staff available and on it may be built as many or as few special tricks of pedagogy as the imagination of the total teaching faculty may provide; its virtue is that it is living medicine—an approach that can be interesting to any doctor, whether he shall become an humble practitioner, exalted specialist, or the medical officer of a great State.

Early Medical Education in Vermont*

ALBERT MONROE CRAM
Bridgewater, Vermont

This being Vermont's Sesquicentennial year and as nearly every town in Vermont is celebrating in one way or another the birth of the State into this great country of ours, it seems fitting that we, as an organization of medical men, should do a bit of reminiscing.

Previous to the close of the French and Indian War in 1763 there were few doctors in what is now Vermont. Doubtless there were some surgeons with the invading armies. Dr. Jonas Fay was surgeon under Ethan Allen at the time of the capture of Ft. Ticonderoga in 1775. The same year, Dr. Reuben Jones likely stanched the first blood shed in the American Revolution at the Westminister massacre. Dr. Benjamin Warner, father of one of the famous Green Mountain Boys, lived in Bennington previous to the Revolution.

Dr. Stephen Powers was one of the early settlers of Woodstock. In the spring of 1775, on hearing of military movements in Massachusetts, he went down there a short time before the battle of Bunker Hill and was present on the battlefield while the fight was going on and assisted in caring for the wounded. Dr. Powers was a man who did not care for personal adornment. Among his articles of apparel was a pair of trousers made of buckskin which he wore even to the close of his life in 1809. From the nature of the material he made handy use of this garment in sharpening surgical instruments when performing operations. As a practitioner of the healing art, his name was widely known among the learned in his profession.

Many of the early Vermont doctors were farmers, lawyers and politicians of the time, thereby gaining a livelihood, as few doctors had a practice large enough to support their families. When final action was taken on the independence of Vermont, in 1777, that document was signed by four delegates, two of whom, Jonas Fay and Reuben Jones, were doctors.

Dr. Silas Hedges of Clarendon was a surgeon in the Continental Army under General Washington. Dr. Frederick Aubrey of Bradford was a surgeon in the British Army and dressed the wounds of General Wolfe at Quebec. Dr. Roebeck of Grand Isle was surgeon in the German Contingent of the British Army at the battles of Hubbarton and Bennington. Having no money to buy drugs, he used many of Nature's remedies. He is quoted as saying "Indian hemp is good for dropsy, spigot root for internal bruises, and the bark of the red willow is a sure remedy for fever and ague. Burdock root with blackberry and white ash bark, steeped in cider, is the very best remedy for spring jaundice."

In 1814, Dr. F. W. Adams amputated the leg of a smuggler who had been shot. He used a beech withe for a tourniquet and a razor and sash saw as his only instruments. Dr. Adams Johnson of Danbury was attacked by wolves one night

*Address delivered at the annual meeting of the Vermont State Medical Society, October 2, 1941.

when returning from a late call, and threw his saddle bags among them, thus making his escape. He afterward remarked "Those bags saved life that night if never before."

Most cases of obstetrics were cared for by midwives who traveled many miles through the woods or were drawn on hand sleds to care for the mothers and babies. Mrs. Whitmore of Marborough, wife of an early settler, was an example, and officiated in more than two thousand births without the loss of a mother.

The early doctors of Vermont were mostly born and not made. There was no law governing the practice of medicine until 1876, except from 1820 to 1838 when the right to collect fees was regulated. Anyone might practice, provided he could find patients who were willing to take his medicine. Very few of the early physicians had a degree of M.D.

In the eighteenth century, medical education in New England was at a low ebb. A number of doctors educated abroad came to the Colonies and practiced and taught students, who, in turn, practiced and taught other students until the degree of medical education became sadly diluted but it was the beginning of our early method of medical education. Some of these early physicians became outstanding as preceptors, attracting many students. Up until 1765, all medical education was under the preceptor system. In that year, the medical school of the College of Pennsylvania was established, being the first medical school in the Colonies, followed by Columbia in 1767, Harvard in 1782, Queens in 1792, Dartmouth in 1798, and Translyvania in 1799. As a rule, these medical colleges were not popular, all of them up to 1801 graduating only 312 physicians, an average of less than ten per year.

Out of the preceptor system grew another type of school known as the "independent." Some of the preceptors became so popular that they were unable to instruct, without assistance, all the students who came to them. They, therefore, gathered around them other prominent physicians and started this independent type of school. There was also another class, which was organized by medical societies. Some schools were established by the joint action of state medical societies and colleges. Most of these schools were located in cities.

The independent type of medical school established in small towns seemed best adapted to this State. The first school of this type was the Castleton Academy of Medicine, established and owned by two individuals, Dr. Selah Gridley and Dr. Theodore Woodward, with the cooperation of Dr. John Cazier. It was the first medical school in the United States that was entirely independent. It was established under an individual state charter, a type of school that was later termed proprietary, and was a pattern for many of the privately owned schools which followed during the early part of the nineteenth century. The name of this school was later changed to the Vermont Academy of Medicine and again to Castleton Medical College.

Dr. Gridley, through his personality and ability, acquired a good practice and attracted a considerable number of students. He was not only a country doctor, but a merchant, a prominent politician, student of medicine and a poet.

Dr. Gridley's home was the center of the educational life of the villege of Castleton. He was an eccentric man and about 1820 his eccentricity increased. He finally developed paranoia and died at the age of 56.

Dr. Theodore Woodward was a student in the medical school in Hanover for one session but did not graduate. He was a nephew of that prominent medical teacher, Dr. Nathan Smith, who established the New Hampshire medical institution, later known as Dartmouth Medical College, and also the Yale medical institution. Dr. Woodward studied under his uncle at Hanover and gained much knowledge in connection with the administration of other medical schools which contributed largely to his successful career in medical education. Because of ill health, he was forced to give up practice and teaching in 1838, and his loss to the Castleton school was so great that it was suspended for two years. It is a peculiar coincidence that both Dr. Woodward and Dr. Gridley became insane. Dr. Woodward died in the Vermont Insane Hospital at Brattleboro at the age of 52 years.

At the beginning, a building was purchased and prepared for the reception of students at the expense of Gridley and Woodward. Each doctor loaned books, which constituted the medical library of the institution. The lecture term was divided into four courses, one on anatomy and physiology, one in chemistry, one on materia medica and institutes and practice of medicine, and one on surgery and obstetrics. It is noteworthy that none of the doctors constituting the faculty of the first medical school had a degree in medicine. The fees from the lecture courses, $55.00 for each student, were divided equally among the faculty.

In the early development of the curriculum of the school, each calendar year was divided into three terms, each of fourteen weeks duration. One was a lecture term, and two terms were reading terms. The reading terms were optional and were taken by those students who lacked competent preceptors. The school opened February 25, 1818. At this time it had no charter but it is likely that Dr. Gridley already had assurance from members of the Legislature of Vermont that the charter would be forthcoming. It was customary at that time to hold the State Medical Society meeting at the Capitol after the Legislature had convened, and the evening meeting was held in the Legislative Chambers. There evidently was a very friendly relation between the Legislature and the Medical Society. Dr. Gridley, being one of the two most influential men in the Medical Society, had little trouble in procuring the charter which was granted October 29, 1818. This charter gave the power of instruction in physic, surgery, chemistry, and all the different branches of science connected with the healing art but failed to give any power to grant degrees. Evidently, this was an oversight, as the following year an amendment gave this power to the President of the Academy with the consent of the professors of the Academy. Earlier in the year, arrangements had been made with Middlebury College which made a degree granted by two corporations especially attractive.

Two delegates were elected by the State Medical Society to participate in the examinations of candidates for the degrees at the new medical school.

The Castleton school had a thoroughly honorable career until the outbreak of the Civil War when the competition of the re-founded medical department of the University of Vermont made it necessary to close the school in 1861. It graduated between fifteen and sixteen hundred physicians among whom was William Tulley whose name is perpetuated in the profession by "Tulley Powder." Solomon Foot and Horace Green later became authorities on diseases of the throat and chest, and Frank H. Hamilton was one of the great surgeons of America.

The second medical school to be established in Vermont grew out of the efforts of a prominent practitioner in much the same manner as the Castleton school but differed in that it did not remain an independent school but later became a part of the University of Vermont. Dr. John Pomeroy, a prominent physician in Burlington, gave a regular course of lectures on anatomy and surgery in the winter of 1814 in the building which he secured on Water Street. At times he also had the assistance of other doctors in the subjects of obstetrics and practice. John N. Pomeroy, his son, was a chemist, not a doctor, but in 1816 he delivered a course of sixteen lectures on chemistry to his father's students, which is believed to be the first regular course of lectures on chemistry ever given in this country to a medical class. In 1815, Dr. Pomeroy was allowed to hold classes in two rooms in the college building. In 1817, he resigned his professorship in anatomy and physiology but continued to fill the chair of surgery. His school became the medical department of the University in 1822. Besides Dr. Pomeroy the faculty was greatly strengthened by the appointment of Dr. Nathan Smith, founder of Dartmouth and other medical schools, as lecturer in medicine and surgery. Dr. Smith was then considered the personification of medical education in New England.

The first medical degrees were conferred in 1823. A special committee of the corporation in 1825 recommended the following relating to the conferring of medical degrees: "Practitioners of Physic who have sustained respectable standing in their profession for five years previous to the year 1822 and who have attended one course of medical lectures in this University and otherwise complied with the aforesaid regulations may, nevertheless, be admitted to the examination for a degree of Doctor of Medicine." This gives us some idea of the standards of the profession at that time.

The Medical Department of the University erected a new building in 1829, but by 1836 the number of students had dwindled until only one degree was conferred in the Department. Due largely to the competition encountered from the Castleton, Woodstock and Hanover schools, this department was abandoned. In 1854, through the efforts of Dr. William Thayer and Dr. Levi Bliss the school was reopened on its own merits and has continued to function since.

In 1884 an entirely new building was erected on the present site of the Medical College. It was burned in 1903. Under the leadership of Dr. Henry C. Tinkham, a new, modern building was erected ready for use in 1906. The late history of the school does not come into the scope of this paper, but it has ever

kept abreast of the times and has graduated 3,278 doctors who are located in nearly every state in the Union. A large percentage of the present physicians in Vermont are graduates of this school.

The third medical school was established at Woodstock under the leadership of Dr. Joseph Adam Gallup. In 1820, he was elected Professor of Theory and Practice of Medicine in the Castleton Medical Academy and in December of the same year became President of the Corporation. In 1821, he also became Professor of Materia Medica and Jurisprudence in that institution. Dr. Gallup was a man of great ability and a successful practitioner but was said to be erratic and eccentric. One of his eccentricities was that he referred to himself as "Joadam" Gallup. This contraction of his name may have been an imitation of his great grandfather who was known as Benadam Gallup. Various clashes between him and other members of that school resulted in his resignation in 1824. The next year he was lecturer on Theory and Practice of Physic and Materia Medica at the University of Vermont. Again he could not agree with other members of the faculty and did not return for a second term. Dr. Gallup was an important figure in Vermont medicine. He not only studied under the preceptor system but was one of the first two students who graduated from the Dartmouth Medical College in 1798, receiving the degree of Bachelor of Medicine. In 1799 he settled in Woodstock.

Dr. Gallup was not only a successful practitioner but a light on all medical subjects. Some of his books, such as "Remarks on Pulmonary Consumption," "Pathological Relations on the Supertonic State of Diseases," and "Outlines of the Institutes of Medicine," were used as a basis for medical examinations in Vermont. He was elected Vice-President of the State Medical Society in 1817, and the year following he became President, which office he held for a period of ten years. When he resigned, the Medical Society became inactive. Dr. Gallup was a successful teacher but as we have seen, was in discord with the leaders in both of the other medical schools in the State. In 1826, Dr. Gallup felt that there should be a medical school in the eastern part of the State and proposed the establishment of a school at Woodstock under the name of the Clinical School of Medicine. Since there were two medical schools already in the State and the Dartmouth Medical College only twenty miles distant, it would appear that it was Dr. Gallup's ambition to teach and probably a desire to compete with the two other medical faculties of the state, with both of which he had quarreled, led up to the establishment of the Woodstock school. The first lectures were held in March, 1827, in Cuttings Hotel.

Because of opposition from the other medical schools, Dr. Gallup's efforts to obtain a charter were fruitless, hence instructions were suspended at the end of the year 1827. Dr. Gallup was finally successful in obtaining an affiliation with Waterville College in Maine, which college agreed to confer the degrees. The first term began March 4, 1830, and continued thirteen weeks.

There was no laboratory work, except dissecting. One of the difficulties that the early medical schools had was to obtain anatomical subjects and many interesting stories might be told of private resurrections, as grave robbing was then

called. The grave of a young woman at Barnard was discovered to be empty during the first session of this school and a body of citizens from that town searched the medical building at Woodstock but failed to find the body. Arrests were made but there was no conviction. Most of the early medical schools had a cupola which was useful as well as ornamental, for when a raid on the medical school was expected, cadavers were hoisted by block and tackle through a trap door where they remained hidden during the raids made by the infuriated citizens. The faculty of the Woodstock school finally pledged themselves to molest no bodies in the immediate vicinity of the school.

All students, beginners and advanced, attended the same lectures. If a student returned the second year he listened to the repetition of those heard the year before unless there was some change in the faculty. It was also possible for medical students to take one course of lectures at Woodstock and migrate along with some of the faculty to the Berkshire school in Massachusetts and get their second course of lectures during the same year, thus saving a year's time. It is interesting to note that the students from the Woodstock school were once entrusted with the transportation of much of the equipment which was carried to the Berkshire school, but on arrival most of the equipment failed to show up and it was found that the students had pawned the articles for lodging and drinks on the way. It was necessary to send some one back over the route and gather up the articles in hock.

In 1831, Dr. Benjamin Lincoln, then on the faculty of the University of Vermont Medical School, published a series of letters attacking both the Woodstock and Castleton schools, under the title "Hints of Present State of Medical Education and Influence of Medical Schools in New England." Dr. Lincoln's attacks were extremely personal being directed against Dr. Woodward of the Castleton school and Dr. Gallup of the Woodstock school. Dr. Lincoln accused Dr. Gallup of creating an individual school and assuming the title of professor and then selecting a college of a foreign state to grant diplomas. We quote from Dr. Lincoln:

"How long would it be before some other Town in Vermont should afford an opportunity to some enterprising individual, anxious to fill a Professor's Chair and give Clinical Lectures to establish his Hospital and set up another Clinical School? There are Diplomas enough in the State of Maine yet: they grow wild on the banks of the Kennebeck, above tidewater."

These criticisms of "diplomas of a foreign state" by a professor in the University of Vermont were somewhat gratuitous in view of the fact that in 1825 the trustees of that University agreed for a period of five years to confer the medical degree on students of an unchartered group of medical teachers at Troy, New York. It is doubtful if this deterred many students from attending the Woodstock school.

In 1833, a question arose as to the legality of the degrees conferred on graduates of the school by the Waterville College, so in 1834 affiliation was made with Middlebury College to confer the degrees. The total number of degrees conferred by the Waterville College was fifty-five. In 1834, differences arose

between Dr. Gallup and Dr. Palmer, who was also a Professor at the Berkshire Medical Institution. There were two factions both among the faculty and among the town's people. In January, 1834, there appeared two advertisements in different columns of the local newspaper, each announcing the opening of the session of the Clinical School of Medicine on March 1st. There were two different faculties, one headed by Dr. Gallup and the other by Dr. Palmer. One prominent resident said that Woodstock had the distinction of being the only town in the United States, except Philadelphia, that had two medical schools. He was mistaken as there were also at that time two medical schools in Baltimore.

Dr. Gallup was finally influenced by some of his friends outside the medical profession to withdraw from the medical school as it was impossible for two schools to exist in such a small town. Dr. Gallup's place was taken by Dr. Henry Halsey Childs, founder of the Berkshire Medical Institution.

After Dr. Gallup's severance with the school, the organization had little trouble in obtaining a charter from the State Legislature in 1835, but Middlebury continued to grant the degrees until 1837, having granted seventy-four to students of Woodstock. The name "Clinical School of Medicine" invented by Dr. Gallup was an innovation in American medical education, as it contemplated clinical teaching in the medical school which was not in accord with the accepted theory of medical education in the United States at that time. The accepted theory was didactic teaching by the school and clinical instruction by the preceptor method. Practitioners were jealous of their function as private teachers as it gave the preceptor prestige as a doctor.

The fee paid preceptors by the students was usually $100 a year. Thus, we can see why some of the schools connected with a university were not popular in medical circles.

From 1834 on, the Woodstock school became an independent school. Its faculty and curriculum were increased from time to time, the number of weeks being increased from twelve to twenty by 1846 in response to the standard set by the American Medical Association. Thus we see the school tried to raise its standards of medical education to conform to the highest standards of the time. The increase in the attendance of the Vermont Medical College, as it was now called under the charter, was so great that a new building was erected on what is known as College Hill. It was said to be an ideal location being removed from the noise and confusion of the business section of the town. The noise and confusion of those days must have consisted of the occasional passing of a lumber wagon or the jingle of sleigh bells in the winter.

Its catalogue of 1849 says, "The faculty have for several sessions held a clinique not only for surgery but for medical cases." This was really a distinction for a country medical school. The college also had added several achromatic microscopes, which was a distinction few medical schools of the entire country possessed. Few doctors of that time had even looked through a microscope, the first having been manufactured in America in 1838.

From 1834 to 1854, there were seven instructors on the faculty of the Vermont Medical College and only one change which likely contributed to its

great prosperity during those years. The college continued until 1856 when several of the faculty resigned and it was forced to close its doors, partly because of hard times and partly because of the increased popularity of the Schools at Burlington and Dartmouth. The total number of graduates was five hundred and forty-four.

Attempts were made to start three other medical schools in Vermont, viz: Vermont Medical College, Rutland, in 1883; Trinity University College of Medicine and Surgery of the State of Vermont, Bennington, 1889, and Union Medical Institute, Newbury, 1887, none of which amounted to anything and were reported fraudulent. Castleton was also forced to close its doors in 1861 and since that time the medical department of the University of Vermont has been the only medical school in Vermont.

The medical societies in Vermont played an important part in promoting medical education. It has been one hundred and fifty-seven years since "The First Medical Society" in Vermont was formed by the doctors of Rutland and Benning counties. Windham, Franklin and Windsor counties, and others, followed until Vermont had a nearly complete county organization. The State Society was the result of these county organizations and received its original charter in 1813, holding its first meeting in Montpelier, July 7, 1814. It entered into a vigorous existence and became very active in public health matters. One of its chief functions was the regulation of admission of members into the profession. The State Society sent delegates to the examinations of each of the medical colleges and was very influential in raising the standards of medical education. Because of the deplorable standards of entrance requirements, both to college and practice, a special committee was appointed and reported to the State Society in 1825. Entrance requirements to the schools were raised by requiring either three or four years of study with a licensed practitioner or the degree of A.B. The degree of Bachelor of Medicine instead of Doctor of Medicine was given students after the above period of time and the degree of M.D. was conferred on those who merited it, seven years after the degree of M.B. was granted.

The action of the Vermont Society speaks well for the progressive spirit which animated it in those days, as it urged other state medical societies to adopt such regulations. The State Medical Society continued until 1829, Dr. Joseph Gallup having been President for ten years. Then, because of the lack of interest, twelve years elapsed before the State Society was reorganized in October, 1841. Since that time the Society has held regular annual meetings and has continued to exert its influence on medical education in Vermont.

It is hard for us who have studied medicine during the present age of medical research to imagine a medical college with no microscopes, no knowledge of bacteriology or microscopic pathology. We must remember only sixty years have passed since Koch's classical series of investigations into bacteriology made the study of modern bacteriology possible. It is little wonder that the progress of early medical education was slow. Many of the early methods now seem primitive but medical education in Vermont has ever kept abreast of the times.

JOURNAL
OF THE
Association *of* American Medical Colleges

Volume 17 JULY, 1942 Number 4

The Accelerated Program

The University of Kansas School of Medicine has decided to accelerate. The next freshman class began work June 2nd. Only one admission per year will be made—in June. Vanderbilt is on a fully accelerated program.

This leaves the following schools not accelerated: Oklahoma, Howard, Meharry, Baylor, North Dakota and Arkansas. All but fifteen schools will admit students every nine months. These fifteen schools are: College of Medical Evangelists, Stanford, Southern California, Howard, Tulane, Michigan, Syracuse, Buffalo, Oklahoma, Woman's, Meharry, Baylor, Wisconsin, Arkansas and North Dakota. These schools will admit a new class either in June, July, September or October. Ten of these fifteen schools have adopted the accelerated program for all classes. The entering class for 1942 will therefore graduate in three calendar years. In the six schools not accelerating the course of instruction remains as heretofore, extending through four calendar years. The University of Oklahoma School of Medicine is waiting for legislative authorization to accelerate.

◆ ◆

Students Urged to Continue College Education

The War Department announced its Enlisted Reserve Corps plan for college students. In general it calls for the voluntary enlistment in the Army Enlisted Reserve Corps of a certain number of college students possessing superior qualification, such students to remain for the time being in an inactive status in order to continue their education.

Somewhat similar plans have already been announced by the Navy and the Army Air Forces. All of these plans have been adopted in the belief that further education for the purpose of acquiring special knowledge and of developing certain definite capacities for leadership will be of substantial value to the Army and Navy when the men thus enlisted are called to active duty.

The Army and Navy alike appreciate the spirit of patriotism and self-sacrifice which has led an increasing number of young men to forego, in whole or in part, a college education in order to be immediately available to the armed forces through enlistment. The Army and Navy recognize, however, that it is imperative to the success of the war effort that there continue to flow not merely into industry but also into the armed forces numbers of men having the requisite educational background for rapid assimilation into certain increasingly important and increasingly technical fields of industrial and military service.

In connection with this effort to create a reserve pool to provide the armed forces with a steady flow of educated personnel, the Secretary of War and the Secretary of the Navy desire to make their position clear with respect to this matter of continuance of college education. They are convinced that able-bodied young men must and will be controlled in their decisions solely by what appears to each to be his duty in helping to win this war. They are further satisfied that the colleges must and will be similarly guided in their action. Colleges have a definite educational function to perform in war as well as in peace but it is somewhat different.

The country can no longer afford to have young men proceed with their education at a moderate tempo. Extra

curriculum activities not specifically directed toward physical or mental preparation for participation in the war effort can no longer be encouraged. In war times, recreation in college life must be limited to that necessary for a healthy and well-rounded existence. In other words, the colleges in war time must be places of intensive effort and accomplishment. For those colleges which are prepared to proceed with education along these lines, and for those young men who are prepared to enter or remain in college with these purposes and who have the qualities of mind and character to carry them out, the Army and Navy urge the continuance of college education. The Army and Navy will enlist a substantial number of such men in the appropriate enlisted reserve corps, and under present conditions will leave them on an inactive status to continue their education, subject to immediate call of the Secretary of War or the Secretary of the Navy if for any reason this should thereafter be deemed necessary. Appropriate examinations will be given in the second year, and any men who do not meet the required educational standard, or who otherwise are not deemed to be carrying on their education with promise of developing capacities of leadership will be called to active duty at once.

Men who accept the opportunity of enlistment in the Army or Navy Reserve and who conscientiously devote their efforts in college in the manner indicated and those teachers in the colleges who are necessary for the education of these men may feel assured that they are doing the job their country wants them to do and are performing their full duty in the war effort.

—Frank Knox (Army and Navy Joint Release)

◆ ◆

Uniform Standards of Licensure

An editorial in the May 9 (1942) issue of the Journal of the American Medical Association (State Board Number) stresses the need for uniformity in licensing examinations. The data published in this issue of the J.A.M.A. give striking evidence of lack of uniformity among the various states. Seven states reported not one failure in their 1941 examinations. They did not have a failure in the past five years. Twelve states reported failures of less than 1 per cent during the same period. Other states reported a high percentage of failures.

In New York, 21.8 per cent of the graduates of the medical colleges of that state failed, while 39.4 per cent of the graduates of other approved medical colleges in the United States failed the same examination. Of the 145 graduates of New York state medical colleges who took examinations in other states, 4, or 2.8 per cent failed. On the other hand, New York, which reported the highest percentage of failures among the graduates of approved medical colleges on its own examinations, issued a greater number of licenses on the basis of credentials, without examination, than did any other state.

A study of the results of state board examinations always is interesting. It emphasizes the lack of uniformity which is not in the best interests of medical practice. It is often a bar to migration from one state to another—which may become greater after the end of the present war than in previous years. It is a hindrance to licensure by reciprocity which some state boards do not permit at all.

The National Board of Medical Examiners has done much good work to overcome these defects but comparatively few of the graduates of medical colleges take the examination of this Board. Furthermore, not all states recognize the certificate of that Board, which is a pity.

Now is the time for state licensing boards to give serious thought to bring about uniformity — to some extent, at least—in their examinations. A study made by the Secretary of the Association of American Medical Colleges some years ago showed the existence of wide variation in state board examinations. Many years ago, the Association urged that practical examinations be made a part of the examination for licensure.

Some states have incorporated practical examinations in their testing, but the movement is not yet widespread. Practical examinations must be regarded as of greater importance than a written examination, especially when the latter is based on a more or less haphazard selection of questions from a textbook. Would it not be wise for state boards to call to their assistance the members of a medical college faculty who are capable of setting up questions—and furnish the answers for guidance to state examiners? Such a procedure will ensure a much better type of question than is now the case.

It should also be noted that six states licensed graduates of nonapproved colleges! According to information on hand, only those states in which nonapproved medical colleges are situated admit their graduates to the licensing examination. By what procedure did the other states license these graduates?

◆ ◆

Blood and Plasma Banks

Regulations for the administration of the Blood and Plasma Bank Program of the Medical Division of the United States Office of Civilian Defense have now been prescribed, and funds are available for grants to assist approved hospitals in establishing blood and plasma banks. Only hospitals within 300 miles of the Atlantic, Pacific or Gulf coasts are eligible for such grants. After July 1, 1942, these geographical restrictions may be modified, so that grants may be made to inland hospitals. Applications should be addressed to the Chief Medical Officer, United States Office of Civilian Defense, Washington, D. C.

Technical manuals on blood and plasma banks, prepared by the Subcommittee on Blood Substitutes of the Division of Medical Sciences, National Research Council are now available for distribution on request of any hospital to the Chief Medical Officer, Office of Civilian Defense.

The Red Cross has established eighteen donor centers in various parts of the country which are successful in obtaining an adequate supply of blood donors for military purposes. Blood for the production of dried plasma for Civilian Defense purposes will also be obtained from these sources.

Hospitals which establish their own blood and plasma banks with the financial assistance of the Office of Civilian Defense are advised to build up their reserves of blood and plasma by expanding blood collection from relatives and friends of patients who are to receive transfusions. A public campaign for volunteer donors which may compete with the work of the Red Cross should be avoided if possible. If public solicitation is necessary, hospitals should appeal to the local chapters of the American Red Cross for assistance in recruiting hospital donors. Blood donor campaigns by agencies other than the Red Cross will tend to confuse the public and may interfere with the blood collection by the Red Cross for the armed forces.

◆ ◆

Statistics on Licensure

The *Journal of the American Medical Association,* May 9, presents the annual review on licensure for the year 1941. The data are extremely interesting but must be read carefully to get a correct interpretation of the results. Some schools will be disappointed at the record made by their graduates with respect to failures—but in many instances only a few graduates are involved although the percentage of failures is apparently high.

Twenty schools were represented by 1,135 graduates, 21.8 per cent of all applicants for licensure, all passing. This is a very good record. Twelve schools, represented by 892 graduates, had one failure each. One school, with 15 graduates, is charged with 6.7 per cent of failures but this represents only one graduate who failed in the New York State examination, the state which reports the largest number of failures of any state.

Ten schools had more than 10 per cent of failures (14 graduates; 4 fail-

ures), the lowest for any school being 11.1 per cent; the highest, 28.6 per cent. However, of the 670 graduates from these 10 schools, only 123 failed, an average of 18.3 per cent, but 102 failed in the New York State examination, or 15.2 per cent. In states other than New York, only 21 failed, or 3.1 per cent.

Five schools, represented by 493 graduates, each had only two failures, or 2.3 per cent for the group. The lowest percentage of failures in this group was 1.4; the highest 3.5.

Twenty-four state examining boards reported no failures. The total number of examinees from colleges situated in the United States was 5,206 of whom 240, or 4.6 per cent failed.

The Canadian medical schools were represented by 167 graduates of whom 25 failed, or 15.0 per cent. One of the Canadian schools did not have any failures; three had only one failure each (6.7; 14.3; 33.3). The highest percentage of failures was 80.0 (4 graduates).

Two schools had 33.3 per cent failures, representing 1 graduate and 3 graduates, respectively.

The graduates of foreign medical schools numbered 2,138 of whom 1,216 failed, or 59.6 per cent. Of the graduates of extinct medical schools, 4 or 50 per cent failed. Of the 422 graduates of nonapproved medical schools, 194 or 46 per cent failed; 177 of these failed in Massachusetts.

In New York State, 435 graduates were examined of whom 178 failed, or 41.8 per cent. Fifty-two approved schools in the United States are included in these figures; 14 colleges did not have any failures. The largest number of failing graduates came from the medical colleges of New York State.

These data stress the great need for revising the licensing examinations. It would be extremely interesting to know how the graduates of the New York colleges would have fared had they taken the examination in some other state and how those graduates who did not take the New York examination would have fared had they taken it. There is food for thought here and need for action.

◆ ◆

Correction in Application Study

An error was made in the number of applicants accepted for the 1941 freshman class at Columbia University College of Physicians and Surgeons. The report stated that 279 applicants had been accepted. This figure should be 179. Of that number, 126 matriculated according to the enrolment blanks received from Columbia.

Attention has been called previously to discrepancies between the number of applicants accepted and the number who matriculate. This is due to the fact that application cards for all applicants are not sent in; or some matriculants were accepted the previous year and were placed on a waiting list; or some students are repeaters and for these no application card is sent in the following year. Nor do we receive enrolment blanks for the repeaters. They are caught on the supplementary report on repeaters or when the accomplishment reports are received at the end of the year. Every effort is made to have these figures correct by checking all information received during the year.

◆ ◆

National Foundation for Infantile Paralysis

This Foundation has published a pamphlet on the Kenny method of treatment of infantile paralysis. Copies will be sent to any one desiring them by writing to the Foundation at 120 Broadway, New York City. The authors of this monograph are Drs. Wallace H. Cole, Professor of Surgery and Director of the Division of Orthopedic Surgery, University of Minnesota; Dr. John F. Pohl, Clinical Instructor of Orthopedic Surgery, University of Minnesota and Director of the Infantile Paralysis Clinic, Minneapolis General Hospital, and Miland F. Knapp, Clinical Assistant Professor of Radiology and Physical Therapy and Director of Training Courses in Kenny Technique, University of Pennsylvania.

College News

University of Virginia
Medical School

A gift of $25,000 has been received from the estate of William J. Rucker, to be devoted to research in the cause and the treatment of arthritis. The University Hospital will receive, from the same source, about $350,000.

Under the will of Dr. Wm. E. Hopkins, the Medical School will receive about $125,000 on the death of Dr. Hopkins' widow. The income of a specific bequest of $13,432 is to be used for the purchase of medical books and journals for the medical library. Dr. Stephen H. Watts, formerly professor of surgery and gynecology, has established an endowment fund for the purchase of books and periodicals for the library. He contributed $15,000 during the past two years.

The McIntyre Tumor Clinic will receive the residue of the $11,000 estate left by Nancy Vance, a Virginia Public Health Nurse.

The John and Mary R. Markle Foundation has given $2,000 to support investigations on heparin in relation to peritoneal adhesions and other tissue reactions. The National Research Council has given $2,000 for work in endocrinology. E. R. Squibb & Sons appropriated $3,600 for the study of a new arsenical in the treatment of syphilis.

Lectures on the essentials of military medicine are a required course for all fourth year students.

◆ ◆

Medical College
of Virginia

Commencement exercises closing the one hundred fourth session were held June 1. Dr. H. E. Jordan, dean of the department of medicine, University of Virginia, Charlottesville, was the speaker. The honorary degree of Doctor of Science was conferred on Dr. Ramon Suarez, an alumnus, of Santurce, Puerto Rico. Gifts for the current session total $136,520.88. Dr. Peter N. Pastore, an alumnus, has been made professor of otology, laryngology and rhinology.

Dr. Jacques P. Gray, one of the unit directors of the Michigan Community Health project of the W. K. Kellogg Foundation, has been appointed professor of preventive and public health medicine and dean of the school of medicine effective July 1, 1942. Dr. Lee E. Sutton, Jr., who has been dean for the past ten years, will continue as professor of pediatrics. The major part of Doctor Gray's time will be given to the dean's office and associated duties.

The college will begin its accelerated program for the coming session on July 6, the academic year being divided into three quarters of eleven weeks each with two weeks' vacation periods between quarters. This will permit students in the schools of medicine, dentistry, and pharmacy to graduate in three calendar years instead of four.

The annual Stuart McGuire lecturer for the session 1941-1942 was Dr. John B. Youmans of Vanderbilt University. These lectures were combined with the postgraduate clinics on May 7 and 8.

The hospital unit of the college, known as General Hospital 45, has been ordered to active duty. Lieutenant Colonel Powell Williams, associate professor of medicine, recently succeeded Lieutenant Colonel Carrington Williams, professor of clinical surgery, as unit director. Miss Anne Parsons, associate professor of nursing, will head the nursing personnel of the hospital unit.

◆ ◆

Temple University
School of Medicine

Dr. Harvey E. Bacon was appointed professor and head of the department of proctology.

Temple is on the accelerated program.

Wayne University
College of Medicine

A grant of $10,000 from the W. K. Kellogg Foundation has been accepted by the Detroit Board of Education. The money is to aid students with limited means to whom the accelerated educational program in medicine will bring serious financial problems.

Under Wayne's new program, work in the College of Medicine will continue without interruption for summer vacation, so that students will not have their usual opportunities to earn tuition and other expenses in summer. A new freshman class has been admitted June 22, with provision for 75 entering students instead of the customary 65. Another College academic year will begin early in 1943.

The Kellogg grant is to be used for loans to students who have been accepted by the military services, a provision by the armed forces making it possible for medical students to be commissioned and to remain in college on a deferred basis. Loans will be granted on the basis of scholastic ability, character, and need. It is the wish of the Foundation that money so used will be chiefly for the purpose of encouraging exceptional students otherwise unable to enter the field of medicine. Consequently, it is expected that first-year students or students not yet in school, but definitely admitted, will be given a preference rating. Not more than $500 will be loaned to any one student in any year. The grant was made through President George B. Darling of the Kellogg Foundation.

◆ ◆

Long Island College
of Medicine

Dr. Jean A. Curran, dean, has been elected president of the college to succeed Dr. Frank L. Babbott who resigned because of ill health.

Promotions: Dr. Edwin P. Maynard, Jr., clinical professor of medicine; Dr. George Freiman, clinical professor of ophthalmology; Dr. Howard F. Beakey and Dr. Martin A. Murphy, assistant clinical professor of medicine; Dr. Charles B. Jones, assistant clinical professor of surgery; Dr. Mortimer A. Lasky, assistant clinical professor of ophthalmology; Dr. Louis J. Frank, assistant professor of dermatology and syphilology.

The resignation of Dr. Fred L. Moore, professor of preventive medicine and community health has been accepted, to become effective when his successor has been appointed. Dr. Moore resigned to accept the directorship of the Division of Public Health Studies of the Commonwealth Fund.

Dr. Cornelius Packard Rhoads, Director of the Memorial Hospital for Cancer and Allied Diseases, of New York City, has been elected a member of the Board of Trustees of the Long Island College of Medicine, in the class of 1945.

The Luther F. Warren Memorial Lectures for junior students were delivered by:

March 19; "Dermatology and Syphilology as a Career," Professor Arthur W. Grace.

April 7; "Urology as a Career," Professor Fedor L. Senger.

April 14; "Ophthalmology as a Career," Professor John N. Evans.

April 23: "Radiology as a Career," Professor A. L. L. Bell.

April 30; "Neurology as a Career," Professor Orman C. Perkins.

May 7; "Orthopedics as a Career," Professor Joseph B. L'Episcopo.

◆ ◆

Columbia University
College of Physicians and Surgeons

Dr. Vernon W. Lippard, assistant dean has been appointed associate dean.

Promotions: Dr. Alvan L. Barach and Dr. David Seegal to associate professors of clinical medicine; Dr. Donovan J. McCune to associate professor of pediatrics; Dr. Karl Meyer to associate professor of biochemistry; Drs. Hartford Hallock and Leonidas Lantzounis to

associate clinical professors of orthopedic surgery; Dr. André Cournand to assistant professor of medicine; Dr. Paul F. A. Hoefer to assistant professor of neurology; Dr. Edith E. Sproul to assistant professor of pathology; Dr. Ruth A. Miller, Dr. Raymond C. Truex and Dr. Sherwood L. Washburn to assistant professors of anatomy.

The following were promoted to assistant clinical professors: Drs. Samuel C. Burchell, neurology; L. Beverley Chaney, neurology; Armistead C. Crump, medicine; Angus M. Frantz, neurology; Walter O. Klingman, neurology, and Hugh S. McKeown, ophthalmology.

Dr. Robert F. Loeb, professor of medicine, has been named Lambert professor of medicine. Dr. Loeb is the first incumbent of the chair, which was established in honor of Dr. Samuel Waldron Lambert, dean of the school from 1904 to 1919, who died on February 9.

◆ ◆

Medical College of the
State of South Carolina

Dr. Tinsley R. Harrison, professor of medicine, Bowman Gray School of Medicine, Wake Forest College, Winston-Salem, N. C., delivered the second annual J. Marion Sims Lecture on April 17. His subject was "Cardiac Dyspnea." The program was initiated by a banquet at the Fort Sumter Hotel, attended by a large number of the members of the faculty of the College and by members of the J. Marion Sims Society.

The J. Marion Sims Society is one of three undergraduate medical societies at the College. The series of lectures sponsored by this society was begun last year by Dr. Heyward Gibbes of Columbia, S. C. with a biographical sketch of Dr. Sims, whose name the society bears.

The following members of the faculty are now on active duty with the armed forces: Dr. P. G. Jenkins, Lt., USN., Dr. M. E. Cox, Lt., USA., Dr. A. J. Buist, Jr., Lt., USN., Dr. A. J. Brown, Lt., USA. (Now Captain?) Dr. I. R. Wilson, Jr., Lt., USA.

Harvard Medical School

Dr. Walter B. Cannon, George Higginson Professor of Physiology, will retire September 1st, with the title Emeritus. Dr. Cannon is a graduate of Harvard, 1900, and has been a member of the department of physiology since that time. He has held his present position since 1906.

Dr. George W. Thorn, associate professor of medicine, Johns Hopkins University School of Medicine, has been appointed the Hersey Professor of the Theory and Practice of Physic to succeed the late Dr. Soma Weiss.

Dr. René J. Dubos has been appointed George Fabyan professor of comparative pathology and professor of tropical medicine to succeed Dr. Ernest E. Tyzzer, who becomes professor Emeritus.

◆ ◆

University of Buffalo
School of Medicine

Dr. Donald Duncan, formerly professor of anatomy and head of the department in the University of Texas School of Medicine, has been appointed to the same position at Buffalo to succeed the late Dr. Atwill.

◆ ◆

University of Toronto
Faculty of Medicine

The sixteenth Donald C. Balfour lecture in surgery was delivered May 22nd by Dr. Alfred Blalock, professor of surgery, Johns Hopkins University School of Medicine. His subject was, "Traumatic Shock."

◆ ◆

The University of Oklahoma
School of Medicine

The Federal Works Agency allotted $125,000 for the erection of an Isolation Building adjacent to the University and Crippled Children's Hospitals, on the campus of the University of Oklahoma School of Medicine. The amount allotted is to cover the cost of building and equipment.

At the annual meeting of the faculty

a resolution was passed unanimously to the effect that the faculty is in favor of accelerating the course in the medical school and would take on the additional duties. This recommendation was approved by the president and the Board of Regents of the University on June 1, 1942.

As soon as the Legislature meets in the spring of 1943, and the additional funds which are required are made available, the school will begin to operate on an accelerated basis, three semesters per annum, commencing June 1, 1943.

◆ ◆

University of Pennsylvania
School of Medicine

Dr. Edward S. Thorpe, for many years assistant to the dean, has resigned to accept the medical directorship of St. Paul's School in Concord, New Hampshire. Dr. Thorpe was also for long a member of the Committee on Medical Aptitude Test of the Association of American Medical Colleges and chairman for five years.

The will of the late Dr. Howard A. Sutton stipulates that his medical instruments and books are to be offered for sale to members of the medical fraternity Alpha Mu Pi Omega, the proceeds to be used to purchase medals to be awarded annually to the undergraduate member of the fraternity who shall have attained the highest scholastic standing during the preceding year at the University of Pennsylvania. Dr. Sutton at one time served on the faculty of the department of anatomy at the university medical school. He died March 21.

◆ ◆

Yale University
School of Medicine

The 51 members of the graduating class will intern in hospitals in 15 states. The majority are registered for military or naval service.

On June 29, the School began the accelerated program. The entering class has been enlarged by 20 per cent—from 50 to 60—to meet the war emergency.

University of Illinois
College of Medicine

The newly constructed Illinois Psychiatric Institute was dedicated with appropriate exercises June 6th. It is a joint undertaking of the Department of Public Welfare of the State of Illinois and of the University of Illinois. The Department of Public Welfare is represented by Dr. Harry R. Hoffman, executive officer of the Institute and State alienist, and associate professor of psychiatry in the College of Medicine. Dr. Francis J. Gerty, head of the department of psychiatry in the College of Medicine is the director of the same division in the Institute. Every facility for teaching, research and service to the community and state in the field of nervous, mental and behavior disorders is provided. The facilities of the Institute for Juvenile Research are also made available for teaching and research. Dr. Paul Schroeder is superintendent of this institute and professor of criminology, social hygiene, medical jurisprudence and psychiatry (in charge of child psychology) in the College of Medicine. By action of the general assembly of the State of Illinois, the Research and Educational Hospital (327 beds) and the Illinois Surgical Institute for Children (119 beds) were transferred to the College of Medicine.

◆ ◆

University of Wisconsin
Medical School

Dr. Wm. S. Middleton, dean, has entered the Medical Corps of the United States Army with the rank of Lieutenant Colonel and is at present stationed at Lawson General Hospital in Atlanta, Georgia. Dr. Walter J. Meek, professor of physiology, has been made Acting Dean.

◆ ◆

Washington University
School of Medicine

The Alpha Omega Alpha Lecture was delivered April 30th by Dr. Arthur Purdy Stout of Columbia University. His subject was, "Changing Aspects of Gastric Pathology."

Cornell University
Medical College

Seventy-five students of the Class of 1942, the last to graduate under the traditional four year medical course, received degrees of Doctor of Medicine June 10. The incoming class, entering on July 8th, will study under the accelerated, three year course put into effect by medical colleges to help meet the national need for doctors.

Thirty-three graduates received, with their degrees, commissions as First Lieutenants in the Army Medical Corps, and ten others received commissions as Ensigns in the Navy. The class represents 15 different states and 34 universities.

In the commencement address, Dr. Frank G. Boudreau, Executive Director of the Milbank Memorial Fund, described the responsibilities of medicine and medical men in the present world struggle. A medical officer in the last war, Dr. Boudreau was associated with the Health Organization of the League of Nations for twelve years before taking over the direction of the Milbank Fund.

Acting Dean Joseph C. Hinsey opened the exercises and the physicians' Oath of Hippocrates was administered by Dr. David P. Barr, professor of medicine. Degrees were conferred by President Edmund E. Day of Cornell University, and Army commissions by Lieut.-Colonel Philip B. Connolly, Professor of Military Science and Tactics.

◆ ◆

University of Minnesota
Medical School

The Charles Fremont Dight Institute for the Promotion of Human Genetics is now in operation. Clarence P. Oliver, Ph.D., of the department of zoology, is in charge. Under the will of the late Dr. Dight, the income of a fund of more than $100,000 was bequeathed to the university to endow the institute. Studies will be directed particularly at present to "a search for traits, such as metabolic disturbances, which may have genetic bases but are not recognized as hereditary traits." Dr. Dight once served on the staff of the University of Minnesota Medical School.

◆ ◆

University of Kansas
School of Medicine

Kansas has decided to go on the accelerated program. The 1942 freshman class was admitted June 2nd. The other three classes will begin work in the fall. Only one admission will be made each calendar year—in June.

◆ ◆

Emory University
School of Medicine

Dr. Eugene A. Stead, Jr., of Peter Bent Brigham Hospital, has been appointed professor and head of the department of medicine. Dr. Stead is a graduate of Emory, 1932.

◆ ◆

Meharry Medical College

The W. K. Kellogg Foundation has given Meharry a grant of $250,000 payable over a period of five years, to finance an educational program in medicine, dentistry and nursing.

◆ ◆

University of Vermont
School of Medicine

Dr. Donald Slaughter, professor of pharmacology in the College of Medicine of Baylor University, Dallas, Texas, has accepted the professorship in pharmacology in the University of Vermont.

General News

Support Given to Medicine by American Foundations

The Raymond Rich Associates, New York City, have compiled the information with regard to the support given by Foundations to medicine, research, public health, etc.

Medicine and public health continue to rank first, although education runs a close second, among the objects toward which American foundations now grant an annual total of $40,400,000. The survey embraces reports from 314 leading foundations.

The survey indicates that for medical research, medical education, the erection and support of hospitals, and other purposes related to medicine and public health, foundations granted individuals and institutions 30.4 per cent of their total disbursements, or $12,273,590 during 1940, the latest year for which complete figures are available.

Although the grants of several large foundations provided an important part of the subsidies for medical and public health projects, gifts over one million dollars in 1940 accounted for only 56 per cent of the total grants in this field as compared with the 1937 gifts of over one million dollars, which accounted for 79 per cent of the total for that year. However, the smaller foundations have devoted an increasingly larger share of their income to medical research, thus making up the difference.

The four gifts of more than a million dollars in this field in 1940 were the Rockefeller Foundation, $2,884,054; W. K. Kellogg Foundation, $1,505,480; The Commonwealth Fund, $1,401,730; and The Duke Endowment, $1,086,581. Gifts of the Carnegie Corporation of New York for medicine and public health amounted to $796,104 in 1940. This field has been the chief interest of the John and Mary R. Markle Foundation to the extent of $685,805 and the total of $515,048 expended by the National Foundation for Infantile Paralysis, Inc., is, of course, in this category also.

The physical and biological sciences received the fourth largest share of the grants, a total of $3,783,643. The leading donors of these funds were: The Rockefeller Foundation, with gifts of $2,882,027 in 1940; the General Education Board, $478,825; and the Carnegie Institution of Washington, $151,697.

Thirty-six of the 314 foundations reported upon in the survey each made total grants of $150,000 and more in 1940. Of these, the Rockefeller Foundation led the list with disbursements of $8,735,324. The General Education Board, in process of liquidation, which had made the largest grants in 1937, now appears second in the list with grants of $4,033,495.

Seventeen of the largest foundations made more sizeable disbursements in 1940 than in 1937. Aside from the very large increases in disbursements of two community trusts — the Winston-Salem Foundation and the California Community Foundation — due to the fact that each of these trusts disbursed special moneys during 1940 and these payments were added to the usual grants from income, the largest increase in grants was in the case of the Le Tourneau Foundation, whose disbursements in 1940, all in the field of religion, were four and a half times greater than their 1937 payments. The outside grants of the W. K. Kellogg Foundation were $2,042,096—an increase of 256.6 per cent from $572,685 in 1937; and those of the Zachary Smith Reynolds Foundation, Inc., were $250,000—an increase of 150 per cent from $100,000 in 1937. Payments on grants of the John and Mary R. Markle Foundation totaling $796,221 in 1940 were more than double its disbursements in 1937.

Reform in Teaching Anatomy

It is the experience of most medical practitioners that at their medical schools they were taught many details of anatomy which they have long forgotten. Five teachers of anatomy have published in the *British Medical Journal* a joint letter on the subject. They say that the usual curriculum of anatomy is partly determined by ideas no longer valid. Much is concerned with topographic details important only to the surgical specialist. A curriculum should be planned to provide the best possible education for the general practitioner. Such a training should provide a sound educational approach to any branch of anatomy and a foundation on which the minutiae of applied anatomy for clinical specialization can be built up at a later stage in special courses of instruction. It is far more important that a student should be well acquainted with general anatomic principles than that he should memorize facts of which a large proportion are likely to be of no practical value. Anatomic teaching must cover the whole realm of macroscopic and microscopic structure, and for the proper comprehension of structural organization histology should be taught in direct relation to the study of gross structure and of embryology and histogenesis. Embryologic study should direct attention to morphogenic mechanisms rather than to the descriptive details of developmental stages. Great importance should be attached to courses of instruction, combined with practical study on general principles of structural organization, with special reference to processes of tissue differentiation, growth and repair, structural adaptation in response to functional requirements, and the influence of mechanical, hormonal and other factors in the induction of structural modifications. It has been shown in some schools that courses can be so arranged that all students in the same year study the same part of the body at the same time. Lectures on the anatomy of the living body, radiologic anatomy, histology and embryology can then be planned so as to deal with the part which is being dissected, allowing a much clearer correlation than in the usual curriculum. Lastly, students should be given more instruction on the postnatal growth of the body and its relation to nutritional, hormonal and other factors. A course of lectures on human genetics would be an appropriate sequel to embryology.—London Letter: *J.A.M.A.*, p. 279 May 16, 1942.

◆ ◆

Charles Cook Hastings Foundation

The establishment of a foundation for the prevention and treatment of tuberculosis has been provided for in the will of Charles H. Hastings in memory of his father, Charles Cook Hastings. The will stipulates that the Charles Cook Hastings Home be built either on "several large parcels of property near Beaumont, Calif.; Banning, Calif., or on the Mesa Alta Ranch, near Pasadena," which is also Hastings property. The will instructs the executors to build a sanatorium to be conducted and maintained on a charitable basis. The Hastings estate is reported to amount to more than two million dollars. After payment of annuities to friends and servants, the entire estate will go to the foundation.

◆ ◆

The "Honorary" M.D.

Exercising its "ancient privilege of conferring honorary degrees in medicine," the Connecticut State Medical Society at its Sesquicentennial Celebration, held June 3-4, 1942, conferred an honorary M.D. on Dr. Alice Hamilton, a graduate of the University of Michigan Medical School, 1893, and Yandell Henderson, Ph.D., Yale, 1898, professor emeritus of applied physiology, School of Graduate Studies, Yale University.

Book News

Textbook of Clinical Parasitology: Including Laboratory Identification and Technic

By David L. Belding, M.D., Professor of Bacteriology and Experimental Pathology, Boston University School of Medicine. D. Appleton-Century Company, New York. 1942. Price, $8.50.

A very timely book. Physicians in civilian practice, the armed services and the public health services will find in it the now urgently needed information on protozoan, helminthic and arthropod parasites of man and the practical aspects of the pathology, diagnosis, treatment and prevention of the diseases they produce. The text is featured by its concise morphological descriptions; by the complete coverage of the aspects of immunity and epidemiology; the practical division of space between the more common and the less common parasites in man; the emphasis placed on diagnosis, treatment and prevention; easily consulted charts and tabulations grouping closely allied parasites for a comparison of their morphological and pathological activities; and the inclusion of a separate section on technical methods in diagnosis and treatment. The 1356 illustrations and 4 full page color plates are largely diagrammatic or semi-diagrammatic drawings to scale and are designed to give, independent of the text, a complete picture of the morphology and life cycle of each parasite.

◆ ◆

The Rat: in Laboratory Investigation

By a staff of Thirty Contributors. Edited by John Q. Griffith, Jr., M.D., Associate in Medicine, University of Pennsylvania School of Medicine, and Edmond J. Farris, Ph.D., Associate in Anatomy, Wistar Institute of Anatomy and Biology. J. B. Lippincott Company, Philadelphia. 1942. Price, $7.50.

A book for every one using the rat or any other small laboratory animal.

Here is everything on the laboratory rat! Everything for the technician, the research worker, the man who breeds stock, manages the rat colony, and even the man who must recapture escaped rats . . . because this book covers every detail from breeding to performing a thyroidectomy.

This book brings together twenty-two chapters by recognized authorities. The sections have been carefully designed and written to give a comprehensive treatment of the rat as a laboratory animal in all fields of research. Introductory chapters on Breeding, General Methods and Gross Anatomy are followed by chapters on Embryology, Diet, Teeth, the Digestive System, Metabolism, the Central Nervous System, Psychological Phenomena, Circulation, Hormones, Drugs, Hematology, Radiology, Surgery, Histology, the Osseous System, the Eye, Protozoan and Metazoan Parasitology and Spontaneous Diseases. Included is a new and unique ten-picture sequence covering the estrus cycle and parturition.

The volume thus affords a guide-book of laboratory technics which, while having particular reference to the rat, are applicable to research in general. Every chapter is written by an authority and packed with carefully organized material. Ample bibliographies are included and add greatly to the reference value of the book. The book is richly illustrated and invaluable to scientific investigation in many fields.

◆ ◆

Handbook of Hygiene

By Joseph W. Bigger, M.D., D.P.H., Professor of Bacteriology and Preventive Medicine, University of Dublin. Ed. 2. The Williams & Wilkins Company, Baltimore. 1942. Price, $4.50.

Intended primarily for medical students and for postgraduate students working for a diploma in public health. The sequence of chapters departs from the usual one. Vital statistics come first; then communicable diseases—according to their chief method of spread. The chapter on poisonous gases is timely. The chapter on assessment of normal health is very good. A new chapter deals with the relations between the medical practitioner and the public health service.

◆ ◆

Synopsis of Ano-Rectal Diseases

By Louis J. Hirschman, M.D., Professor of Proctology, Wayne University. Ed. 2. The C. V. Mosby Company, St. Louis. 1942. Price, $4.50.

Describes routine methods and technics which have been found useful and satisfactory in actual practice.

◆ ◆

Synopsis of Materia Medica, Toxicology and Pharmacology

By Forrest R. Davison, Ph.D., M.B., Medical Department, the Upjohn Company. Ed. 2. The C. V. Mosby Company, St. Louis. 1942. Price, $5.75.

Revised and enlarged. Handy book for the medical student to use, especially during his clinical clerkship.